MODEL 1453 & 1453A

PRINTER

(PREFIX 501)

Beckman

Operating and Servicing Manual

Electronic Instruments Division

BII No. 015-436106

MODEL 1453 & 1453A

PRINTER

(PREFIX 501)

SERIAL No. 3660

Beckman
INSTRUMENTS, INC.
ELECTRONIC INSTRUMENTS DIVISION
RICHMOND, CALIFORNIA • 94804

AUGUST 1962
(Rev. 5-69)

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(g) This warranty shall be governed by the laws of the State of California.

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All correspondence concerning the instrument should specify the model and serial number. This information appears on the company nameplate. Any inquiry concerning details of operation, possible modifications, etc., should be addressed to the Sales Department, Electronic Instruments Division of Beckman Instruments, Inc., Richmond, California, 94804.

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Experienced service personnel and special test equipment are available at any of three Regional Service Centers and the factory to perform any necessary repairs. Every effort will be made to expedite the repair of instruments returned for servicing. To obtain warranty service contact your nearest Beckman Service Office, which will give you the necessary instructions for returning the instrument. Beckman Service Offices now in operation are shown on the bottom of this sheet. Instruments returned for service will be sent to the Beckman Service Office, transportation charges prepaid. The instrument will be returned to the purchaser with transportation charges prepaid.

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Fullerton, California 92634

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3900 River Road
Schiller Park, Illinois 60176

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Electronic Instruments Division
U.S. Highway #22 at Summit Road
Mountainside, New Jersey 07091

MODEL 1453A

PLEASE NOTE

For information concerning Models 1453 and 1453A compatibility with integrated circuit voltage levels, refer to Appendix 4, located at the rear of this manual.

Color control at integrated circuit voltage levels is available as a factory modification.

MANUAL REVISIONS

Beckman Instruments is continually striving to provide better quality in its products. As a result, changes are initiated to improve performance and specifications.

Several changes may have been incorporated in your instrument since the manual was last printed. If this is the case, may we impose on you to make these changes to your copy of the manual? All changes are given in the form of addenda, one addendum for each change. They are printed on green-colored paper and inserted, in letter or number sequence, immediately following this page. If a change does not apply to your instrument, please disregard the associated addendum.

PREFIX NUMBERS

The prefix number denotes a generation of manuals. All addenda for a certain prefix number are incorporated in the manual before reprinting and the number increased by one (e.g., "Prefix 500" becomes "Prefix 501").

Addendum A

Please use the following procedure instead of that printed in the manual, Page 2-5, paragraph 2.12:

2.12 REPLACING THE RIBBON

To replace the inked ribbon, follow these steps while referring to Figure 2-5:

1) From each side of the printer remove the upper of the two panel-retaining screws; then loosen the screw directly below it.

2) Tip the front panel forward.

3) On each spool, swing the ribbon spool retainer away from the ribbon spool post; then slide off the spool.

4) Remove and discard the old ribbon and spools.

5) Place the spools on the spool posts so that the ribbon feeds toward the bottom of the spool.

6) Check that the driving stud in each ratchet wheel is engaged in one of the holes in the spool; then lock the spool with the retainer.

7) Thread the ribbon over the guide stud and through the ribbon guides as shown.

8) Take up any slack in the ribbon by turning the spool that is free. Do not use force.

9) Swing the front panel back into place and replace the two retaining screws.

(7-69)

Addendum B

TRANSDUCER ADJUSTMENT

The transducer is generally considered a factory adjustment item requiring little attention, if any, during the normal operating life of the instrument. However, it is a rather critical adjustment and is thus subject to some degradation from mishandling during transportation. As a result, some minor readjustment may be required at the time of initial installation.

continued. . .

Addendum B - continued

Transducer Adjustment - continued

Check-Out

After all other installation procedures have been executed, set the input to the printer for a known, stable set of numbers, preferably all zeros, ones, twos, threes, etc. Then supply a series of print commands and observe the readout. Change the input signals and repeat the procedure. It is recommended that from three to five different series of numbers be tried. If no misprints are observed, your printer is ready to use and requires no readjustment of the transducer. This same procedure is recommended as a periodic maintenance check.

Should an erratic printout be observed, some slight adjustment of the transducer may be required. Use the following procedure.

Adjustment Procedure

Refer to the attached drawing. Note the location of the transducer adjustment screw. With the printer off, this screw can be reached by inserting a long, thin-shafted screwdriver between the print bars and the platen.

If the observed printout is one number lower than programmed in one or more columns, turn the transducer adjustment screw one-quarter to one-half turn clockwise.

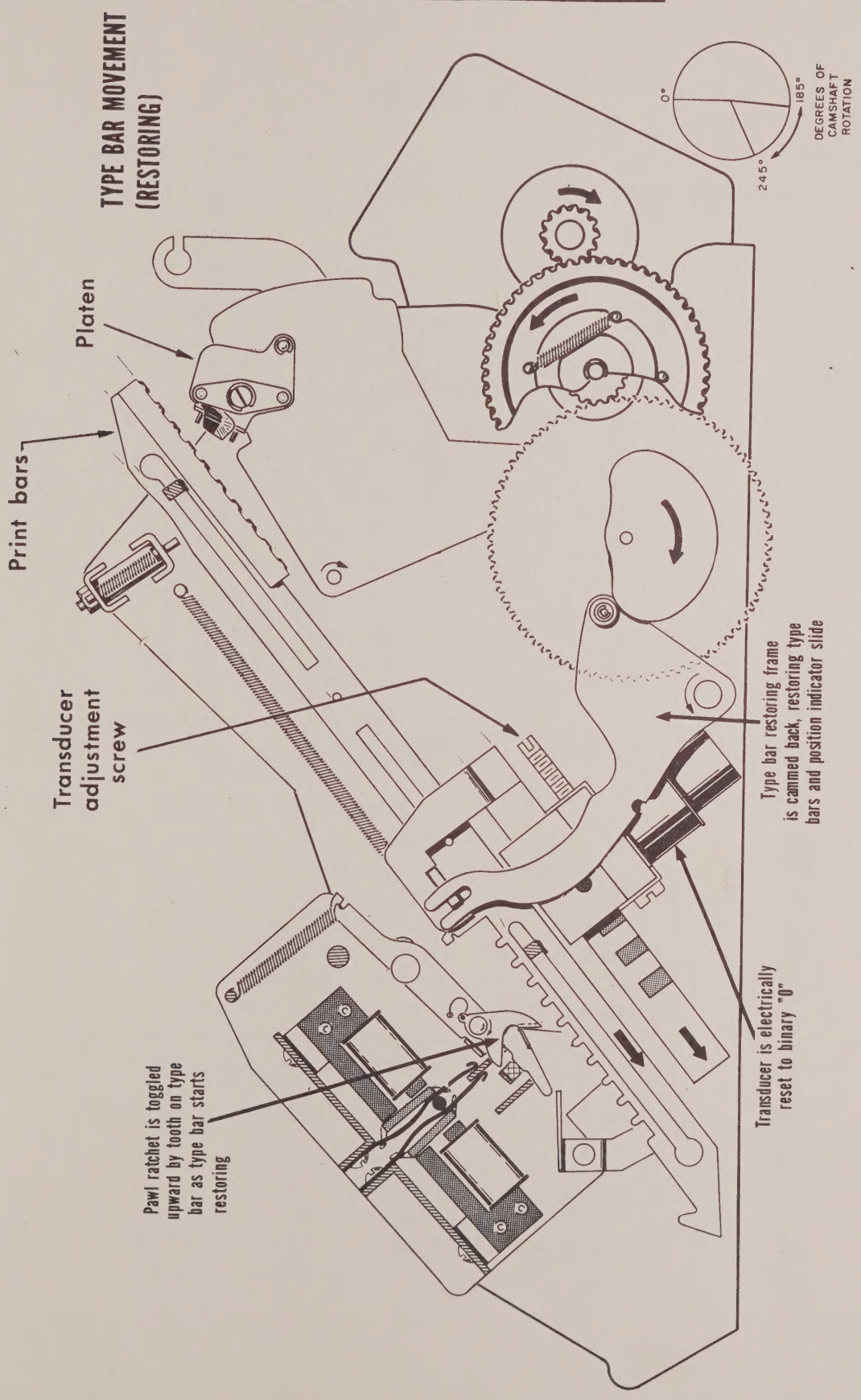
If the observed printout is one number higher than programmed in one or more columns, turn the transducer adjustment screw one-quarter to one-half turn counterclockwise.

After making the above adjustment, recheck the series of numbers previously found in error and repeat the adjustment procedure as required. This should not exceed one and one-half to two turns in either direction from the initial factory set point.

When only one print bar produces a misprint and this cannot be corrected by the above procedure, then inspect for dirt or other foreign particles clinging to the print bar in question and clean as necessary.

If misprinting has not been corrected by the above procedure, contact your nearest Beckman Electronic Instruments Field Service Headquarters for assistance.

TRANSDUCER ADJUSTMENT


TYPE BAR MOVEMENT (RESTORING)
Platen
Print bars
Transducer adjustment screw
Pawl ratchet is toggled upward by tooth on type bar as type bar starts restoring
Transducer is electrically reset to binary "0"
Type bar restoring frame is cammed back, restoring type bars and position indicator slide
0°
185°
245°
DEGREES OF CAMSHAFT ROTATION

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4) Model 1453 Compatibility with Integrated Circuit Voltage Levels

SECTION 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

The Model 1453 and 1453A Printers are identical. They convert electrical data into printed characters on a paper tape, printing up to 12 digits in black or red at a maximum rate of three lines a second. The standard printer has a maximum capacity of eight digits and will accept binary-coded decimal data (BCD) of 1-2-2-4, 1-2-4-2, and 1-2-4-8 weighting. The Model 1453 Printer is shown in Figure 1-1.

Separate plug-in modules, coupled to the main input cable by separate connectors, control each column and permit arrangement of the digits in any order.

Besides the standard four-line BCD modules, ten-line modules are available that will accept both decimal and BCD data. Both types of data can be entered on the same line with these modules.

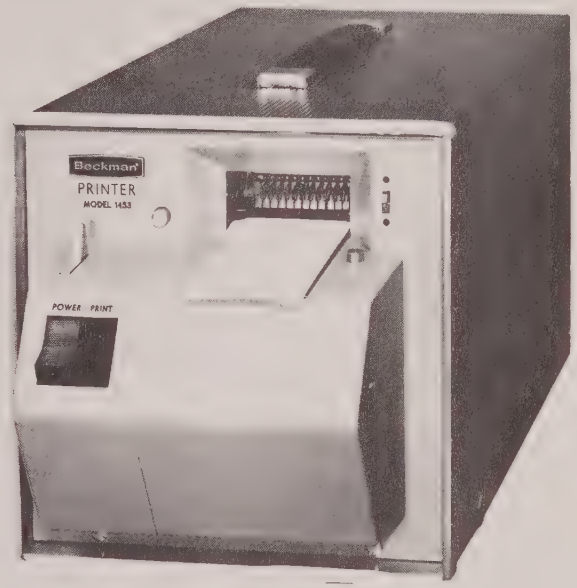


Fig. 1-1. Model 1453 Printer.

1.2 SPECIFICATIONS

Specifications for the Model 1453 Digital Printer are shown in Table 1-1.

Table 1-1. Specifications

Column Capacity	8 to 12 digit columns.
Digit Printout	0 through 9, plus column suppression (blank).
Printing Rate	3 lines per second maximum.
Accuracy	Identical to data input sources.
Control Voltages	Binary 0: -12 to -50 volts (max.) Binary 1: 0 to +50 volts (max.)
Input Code: FOUR-LINE BCD	1-2-2-4, 1-2-4-2, or 1-2-4-8. For 2 megohms (approx.) source impedance per line; Binary 0: -12 to -50 volts (max.) Binary 1: 0 to +50 volts (max.) For 100K ohms (approx.) source impedance per line; Binary 0: -8 to -50 volts (max.) Binary 1: 0 to +50 volts (max.)

. . . continued

Table 1-1. Specifications (continued)

TEN-LINE BCD	Binary 1: 1 wire Binary 0: 9 wires
Input Resistance	FOUR-LINE and TEN-LINE Code Modules: Negative inputs: 10 megohms (approx.) Positive inputs: 200K ohms (approx.)
Code Control	Normally 1-2-2-4 BCD; single line grounded for 1-2-4-8 (1-2-4-2) BCD (1 mA maximum, +10 volts open circuit).
Color Control: Manual Electrical	Two-position lever selects red or black printout. Red: Binary 1 or open circuit Black: Binary 0 Input resistance: 2 megohms (approx.)
Column Suppression	Pin 10 grounded for each column suppressed. (3 mA maximum, +10 volts open circuit) Removal of input code module also suppresses column.
Print Command	Change from binary 1 to binary 0. Binary 0: 100 ms minimum after print command Binary 1: 15 ms minimum before next print command Source resistance: 1 megohm (max.)
Inhibit Reset Command	Occurs no more than 50 ms after print command; 200 ms maximum duration.
Internal Ground	Internal ground is isolated from chassis ground, and can be biased to ±100 volts.
Printing Ribbon	Burroughs adding machine ribbon, 10 key, black and red, medium 7/16 inch (Beckman No. 279-812854).
Paper	Roll tape: Standard 2-1/4 inch (Beckman No. 884-823320) Fan-folded tape: (Beckman No. 884-410460)
Power Requirements	117 volts rms ±10%, 60 Hz. Approximately 0.7 amps, 45 watts
Dimensions: Printer Portable Case (M-1) Rack Adapter (K-1) Bench Cabinet (L-1)	8 inches high; 8 inches wide; 16 inches deep 10 inches high; 9 inches wide; 13 inches deep* 8-3/4 inches high; 19 inches wide; 15-1/4 inches deep* 10-5/8 inches high; 20 inches wide; 15-7/8 inches deep* *(Add 3-1/2 inches to include extended front of printer.)
Net Weight	Portable Case (M-1): 5 pounds Rack Adapter (K-1): 15 pounds Bench Cabinet (L-1): 30 pounds Printer: 30 pounds

SECTION 2
OPERATION

2.1 INSTALLATION

CAUTION

Do not operate printer before removing the three shipping screws and spacers.

During shipment, the printer mechanism is secured to the frame with three shipping screws and spacers. Remove them as follows:

1) Remove printer from its case as described in paragraph 4.1 (Servicing Section 4).
2) Turn printer upside down as shown in Figure 2-1.
3) Locate three red-painted screws and their spacers (Figure 2-1).
4) Hold each spacer in turn with a pair of pliers while removing the screws. Remove spacer.
5) Keep screws and spacers. Use them when shipping the printer.

CAUTION

The printer works only when horizontal. Do not operate it with the front panel more than 30 degrees from the vertical.

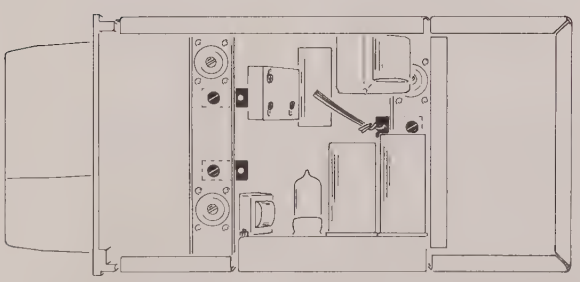


FIG. 2-1. Bottom view of Printer showing shipping screws and spacers.

2.2 MANUAL CONTROLS

With the exception of the code weighting switch on the ten-line code module described in paragraph 3.5.3, the operating controls are on the front panel. Their positions and functions are shown in Figure 2.2.

2.3 ELECTRICAL CONTROL

Table 2-1 summarizes the electrical controls. In this table, binary 0 means 0 to +50 volts (maximum). Note that power ground is not the same as signal ground. See Master Schematic on page 5-3a (dwg. no. D419670).

Pin numbers in the table refer to the individual connectors on the printer. To find the corresponding pins on the main connector, see the Four-Line Input Cable Schematic Diagram on page 5-5b (dwg. no. 62-D-56).

2.4 INSTALLING INPUT CODE MODULES

Follow the arrangement shown in Figure 2-3 when installing modules for use with Beckman data sources such as counters and digital voltmeters. With sources other than Beckman instruments, arrange the modules and connectors to meet requirements.

The twelve sockets marked XA101 through XA112 correspond to the twelve digit columns 1 through 12 (see Figure 2-4). Connectors P104 and P105 are for CONTROL and COLOR, respectively. The printer is supplied with seven four-line input code modules and a main cable that is terminated in nine connectors marked 1 through 8 and C. In this standard configuration, the Model 1453 prints up to seven digits of data. For an eighth digit, insert an extra module.

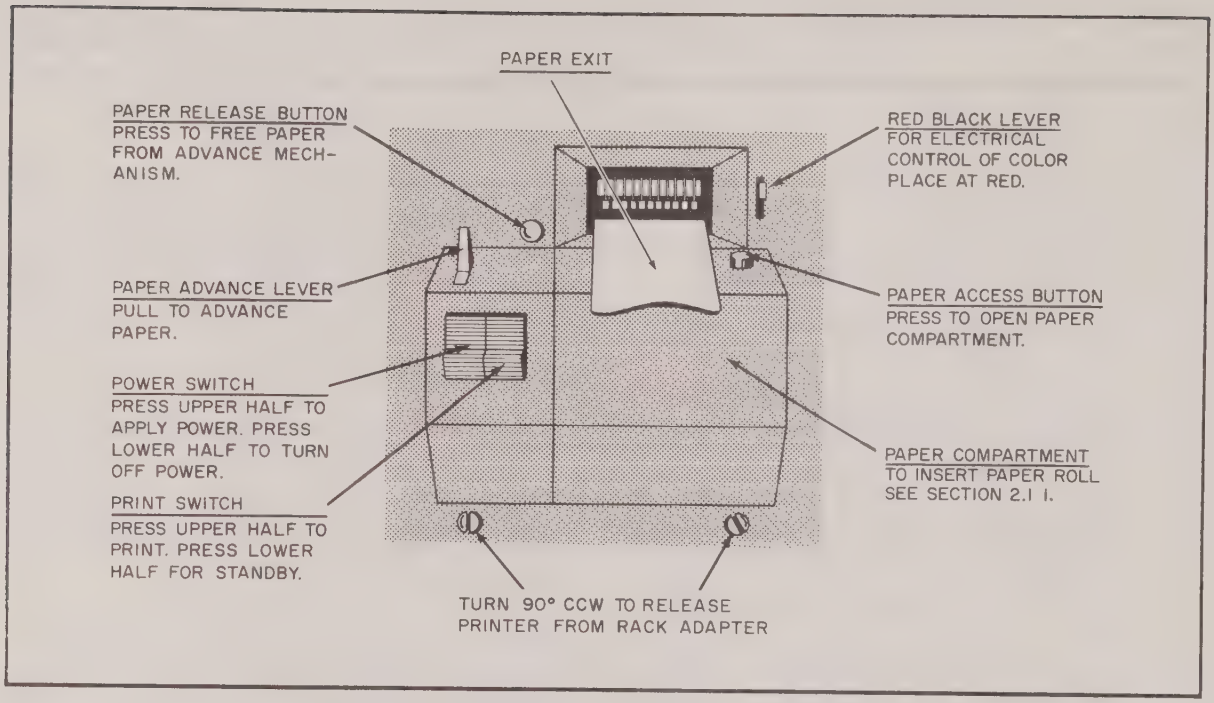

PAPER EXIT
PAPER RELEASE BUTTON
PRESS TO FREE PAPER FROM ADVANCE MECHANISM.
RED BLACK LEVER
FOR ELECTRICAL CONTROL OF COLOR PLACE AT RED.
PAPER ADVANCE LEVER
PULL TO ADVANCE PAPER.
PAPER ACCESS BUTTON
PRESS TO OPEN PAPER COMPARTMENT.
POWER SWITCH
PRESS UPPER HALF TO APPLY POWER. PRESS LOWER HALF TO TURN OFF POWER.
PAPER COMPARTMENT
TO INSERT PAPER ROLL SEE SECTION 2.1 I.
PRINT SWITCH
PRESS UPPER HALF TO PRINT. PRESS LOWER HALF FOR STANDBY.
TURN 90° CCW TO RELEASE PRINTER FROM RACK ADAPTER

FIG. 2-2. Front-panel controls and connectors.

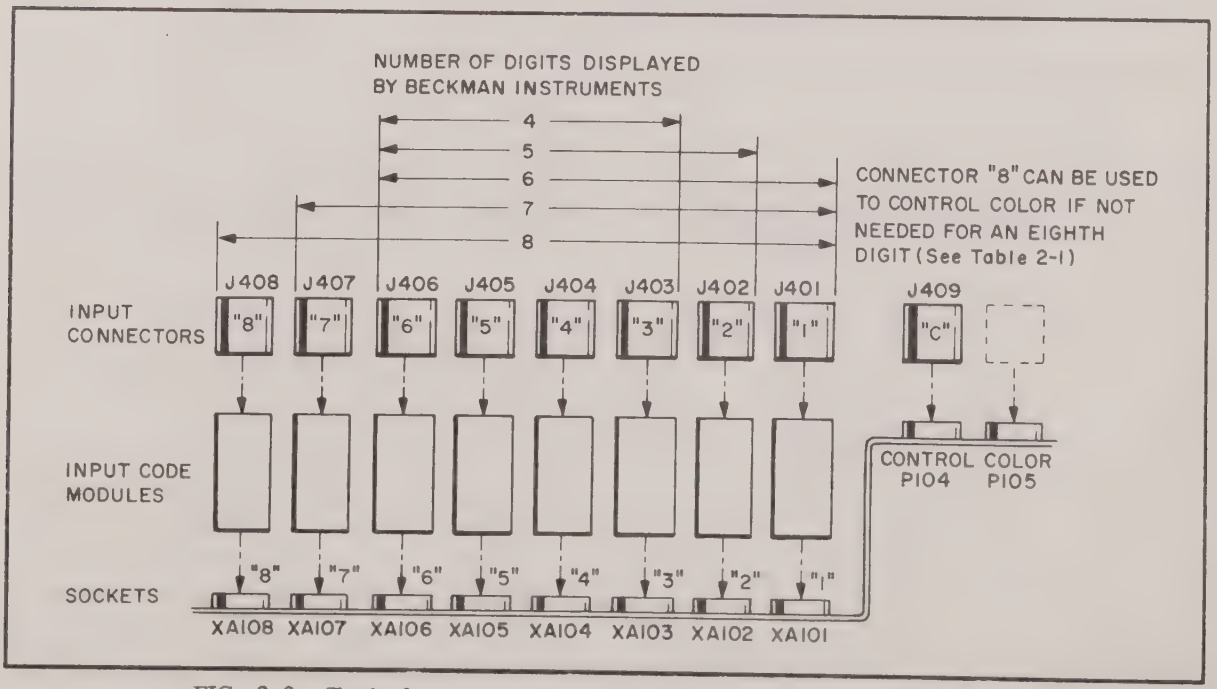

NUMBER OF DIGITS DISPLAYED BY BECKMAN INSTRUMENTS
4
5
6
7
8
CONNECTOR "8" CAN BE USED TO CONTROL COLOR IF NOT NEEDED FOR AN EIGHTH DIGIT (See Table 2-1)
J408 J407 J406 J405 J404 J403 J402 J401
J409
INPUT CONNECTORS
"8" "7" "6" "5" "4" "3" "2" "1"
"C"
INPUT CODE MODULES
CONTROL P104
COLOR P105
SOCKETS
"8" "7" "6" "5" "4" "3" "2" "1"
XA108 XA107 XA106 XA105 XA104 XA103 XA102 XA101

FIG. 2-3. Typical arrangement of input code modules and connectors.

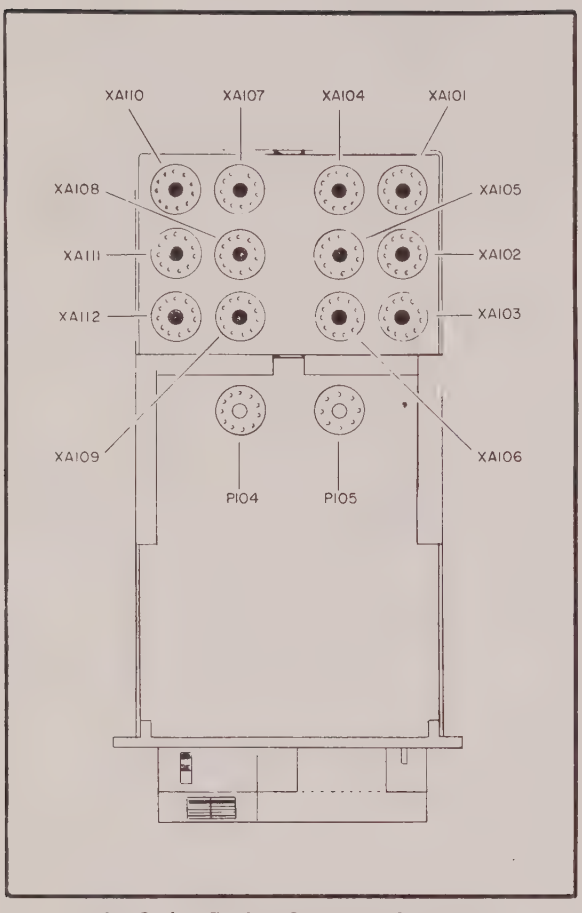


FIG. 2-4. Socket location diagram.

Another version, supplied on special order, has the full complement of twelve pawl magnets and will print up to twelve digits. To identify either version, note whether 8 DIGIT or 12 DIGIT is stamped on the top of the pawl magnet assembly.

2.5 CODE CONTROL WITH FOUR-LINE INPUT CODE MODULES

The code accepted with four-line modules depends on whether or not the code control line is grounded (see Table 2-1). Beckman instruments automatically provide the proper code control signal.

2.6 USING DECIMAL DATA WITH TEN-LINE INPUT CODE MODULES

Decimal input to a ten-line module is on nine lines, each wired to a separate pin, numbered 1 through 9 on the module connector (P201). Pin 10 is used for column suppression (see Table 2-1). A binary 1 voltage on any one line represents the digit corresponding to the pin number. Binary 0 on all lines represents the digit 0.

To operate the printer when all modules are ten-line:

1) Program printer for 1-2-4-8 code (see Table 2-1).

2) Move switch on each module to position marked 1-2-4-8.

2.7 USING MIXED DECIMAL AND BCD DATA WITH TEN-LINE INPUT CODE MODULES

For partial decimal and partly BCD data, proceed as follows:

1) Program printer for BCD code used (see Table 2-1).

2) Set switch on each module receiving BCD input to 1-2-2-4 (regardless of code programmed).

3) Set switch on each module receiving decimal input to 1-2-2-4 or 1-2-4-8 (according to to BCD code programmed).

2.8 USING BCD DATA WITH TEN-LINE INPUT CODE MODULES

BCD input to each ten-line module is on four lines, wired to pins 1, 2, 4, and 6 (corresponding to weights 1, 2, 2, and 4, and 8, in that order) of module connector P201.

Table 2-1. Electrical Control Functions

CONTROL SIGNAL	FUNCTION
Print Command	With print switch at PRINT, a change from binary 1 to binary 0 at pin 5 of J409 starts a printing cycle. Binary 0 must be maintained for 100 milliseconds minimum to start the cycle. The print command line must return to binary 1 for at least 15 milliseconds before next cycle can be started. (Source resistance is one megohm maximum.)
Code Control	Programs printer for input data of 1-2-2-4, 1-2-4-2, or 1-2-4-8 weighting (1-2-4-2 and 1-2-4-8 are the same to the Model 1453). A contact closure from pin 7 of J409 to power ground allows 1-2-4-2 or 1-2-4-8 data to be used. The printer responds to 1-2-2-4 code with pin 7 ungrounded.
Inhibit Reset Command (Pin 1 of J409)	Inhibits data source from resetting until all data printing is complete (generated by the printer). Produces a contact closure through a 220 ohm resistor to power ground (occurs no more than 50 milliseconds after print command and lasts no longer than 200 milliseconds).
Color Control	Permits electrical control of printing color. The RED/BLACK lever must be at RED for electrical control of color. Binary 1 or open circuit at pin 6 of J408 produces a red impression; binary 0 a black impression.
Column Suppression	Produces a blank impression in the column controlled. A contact closure to power ground from pin 10 of the top connector (P201) of any module will suppress the column. Note that pin 10 of connectors 1, 2, 7, and 8 is wired to the main connector. Removing a module will also suppress the corresponding column.

To operate the printer with BCD data:

1) Apply data to pins 1, 2, 4, and 6 of P201.

2) Connect pin 11 (a source of binary 0 bias) to pins 3, 5, 7, 8, and 9.

3) Set switch on each module to 1-2-2-4 regardless of the actual input code.

4) Program printer for 1-2-2-4 or 1-2-4-8, as described under Code Control in Table 2-1.

2.9 IDENTIFYING CONNECTIONS TO INPUT CABLES

Wiring diagrams for the four-line and ten-line cables, respectively, are given on pages 5-5b and 5-6b (dwg. nos. 62-D-56 and C405888).

2.10 CONNECTING A DATA SOURCE

To use the printer with a Beckman Instrument, plug the input cable into the DIGITAL RECORDER

socket on the instrument. This socket carries all the data and control signals needed for automatic operation of the printer.

When using the Model 1453 with Series 6200 and 6300 instruments, refer to the Appendix "Model 1453 Compatibility with Integrated Circuit Voltage Levels" (at rear of manual).

For data sources other than Beckman instruments, use the input cable schematic diagrams to determine appropriate cable connections.

2.11 INSERTING THE PAPER TAPE

Follow these steps to put a roll of paper into the printer:

1) Press paper access button (see Figure 2-2).
2) Let paper compartment drop forward.
3) Place a roll of paper in the spring-loaded holder so that paper feeds from the bottom toward the mechanism.
4) Bend end of paper up. Fold it, making a straight leading edge.
5) Feed end into paper guide below platen (rubber roller).
6) Move paper advance lever forward several times until paper appears in paper exit. Make sure paper is between inked ribbon and platen.
7) Close compartment.
8) Press paper release button and pull paper out until straight.

2.12 REPLACING THE RIBBON

Follow these steps to replace the inked ribbon (refer to Figure 2-5):

1) Remove the two upper panel retaining screws from each side of printer. Loosen screw directly below each.
2) Tip front panel forward.
3) On each spool, swing ribbon spool retainer away from ribbon spool post. Slide off spool.
4) Remove ribbon from one spool. Discard old ribbon and other spool.
5) Attach free end of new ribbon to remaining spool. Make sure black edge is against outer flange of spool.
6) Place spools on spool posts so that ribbon feeds toward bottom of spool.
7) Make sure that driving stud in each ratchet wheel is engaged in one of the holes in spool. Lock spool with retainer.
8) Thread ribbon over ribbon tension arm and through ribbon guides as shown in Figure 2-5.
9) Remove slack in ribbon by turning free spool. Do not use force.
10) Swing front panel back into place. Replace two retaining screws. Tighten screw directly below each retaining screw.

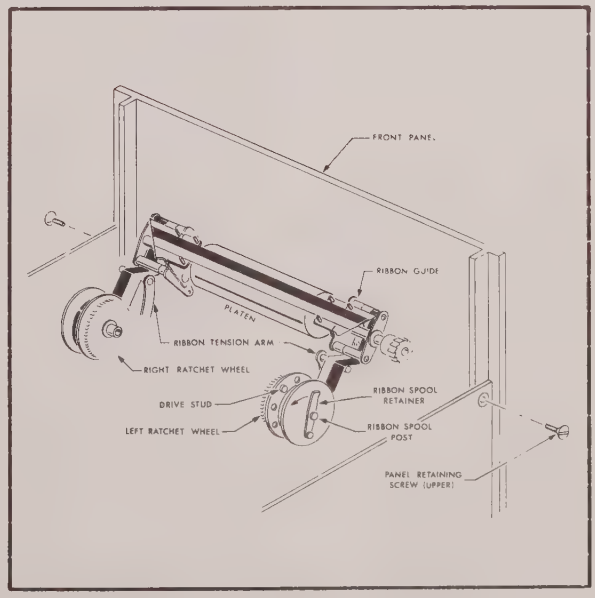


FIG. 2-5. Guide to ribbon replacement.

2.13 APPLYING POWER

Before connecting the printer to the power line:

1) Set POWER switch to OFF (see Figure 2-2).

2) Set PRINT switch to STANDBY.

3) Plug power cord into 117 volt ac outlet.

NOTE

For 230 volt operation, place switch S105 in 230 volt position. (F101 and F102 must be changed to 1/2 amp rating.)

4) Set POWER switch to ON.

5) The motor starts with the clutch disengaged. A light illuminates the paper exit indicating that the printer is ready for use.

2.14 OPERATING THE PRINTER

Complete steps outlined in paragraph 2.1 before operating the printer. To record data, set PRINT switch to PRINT. The printing cycle will take place upon receipt of an external print command.

CAUTION

Set PRINT switch to STANDBY before turning POWER switch to OFF. This precaution ensures that the pawl magnet assembly is mechanically locked in the energized position to prevent dust and lint from accumulating between the armatures and magnets.

SECTION 3
THEORY OF OPERATION

3.1 BASIC DESIGN

The Model 1453 is a motor-driven printing machine controlled by electronic circuits. It records up to twelve digits of data in two colors at rates up to three lines a second. The basic mechanism is a Burroughs Series J ten-key adding machine from which the manually operated listing keys, functional keys, and intermediate keyboard have been removed. Input code modules, pawl magnets, and stop pawls—one set for each column of digits—replace the listing keys and the intermediate keyboard; printing control circuits replace the functional keys.

Data entry takes place during machine operation instead of before (parallel entry, in contrast with serial entry). During data entry, the Model 1453 generates an inhibit reset signal that can be used to stop the input data from changing.

3.2 CIRCUIT LOGIC

Figure 3-1 is a simplified diagram of the circuit logic. In STANDBY, the printer is energized. With the clutch disengaged, the drive motor runs freely. A mechanical lock keeps the stop pawls in the holding position, clear of the type bars.

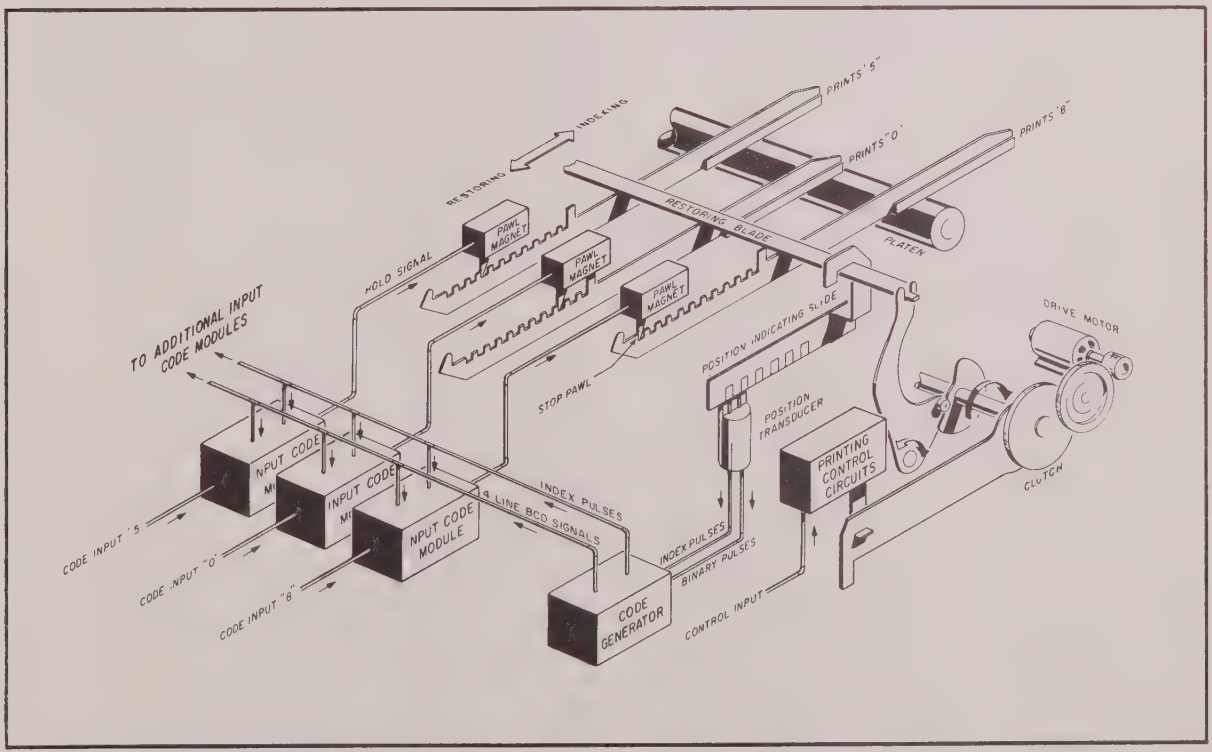


FIG. 3-1. Functional Block Diagram of the Model 1453.

With the STANDBY/PRINT switch at PRINT, the Model 1453 will respond to a print command. When the command arrives, the clutch control circuits engage the clutch, which couples power from the motor through a cam shaft to the printing mechanism.

The excursion control bar starts its indexing movement toward the printing position, followed by the type bars which are held against the control bar by springs. Simultaneously, the lock on the stop pawls is released, leaving the stop pawls held clear of the type bars by a holding current in the pawl magnet coils.

The position indicating slide, which attaches to the excursion control bar, drives the position transducer. The transducer generates indexing and binary pulses representing the decimal position of the type bar assembly. Binary pulses drive the code generator which produces four-line Binary Coded Digit (BCD) signals of 1-2-2-4 or 1-2-4-8 weighting.

Each input code module compares the four-line BCD output of the code generator with the four-line BCD data at its input. When the two data sources coincide, the type bar is in the decimal position corresponding to the input digit. The module responds to the appropriate indexing pulse and cuts off the holding current in the pawl magnet. The stop pawl then drops into a notch on the type bar, stopping the bar in the required position. Typical drop-in time for a pawl is three milliseconds.

If there is no module plugged in for a particular column of digits, or if a column suppression signal is applied, the pawl magnet has no source of holding current. Therefore, the pawl automatically drops into the "no print" notch at the start of the printing cycle, stopping the type bar in a blank position.

When the excursion control bar completes its indexing travel, all type bars have been correctly latched. The platen then rises, pressing the type faces and inked ribbon against a roll of paper to print one line of data. The COLOR lever on the front panel, or a suitable voltage applied to the color control line, will make this impression in either red or black.

After the printing operation, the paper advances one line and the excursion control bar begins its restoring travel, returning the type bars to the starting position and mechanically resetting the pawls. Simultaneously, the position transducer and code generator are reset. Finally, the clutch is mechanically disengaged and the motor then runs freely until the next print command starts a new printing cycle.

3.3 POSITION TRANSDUCER

The position transducer is a mercury-wetted DPST switch, sealed in a capsule that is filled with inert gas under high pressure (see Figure 3-2). Since mercury ensures bounce-free contact, the transducer drives the electronic circuits directly.

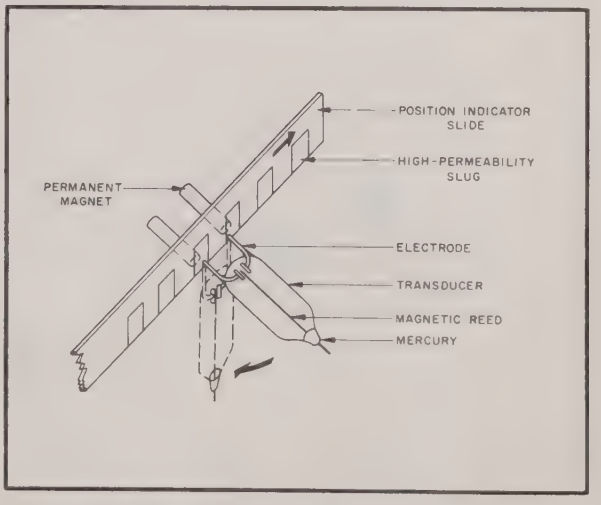


FIG. 3-2. Position Transducer.

Two permanent magnets, one opposite each electrode, establish a symmetrical field near the electrodes. Moving with the excursion control bar, the position indicating slide places magnetic slugs between the magnets and the electrodes. This distorts the field and attracts the magnetic reed in the transducer to the nearest slug. The spacing of the magnets and slugs is such that the reed switches from one electrode to the other for each decimal position of the type bars, generating the first place of a four-line BCD position code. Simultaneously, signals from one electrode trigger the code generator, which provides the other three places of the four-line BCD position code.

3.4 CODE GENERATOR

3.4.1 Design of the Code Generator

A position transducer and three binary, or flip-flop, stages (Q101-Q102, Q103-Q104, and Q105-Q106) comprise the code generator, which produces four-line BCD signals representing the decimal position of the type bar assembly.

Figures 3-3 and 3-4 illustrate code generator logic and output wave shapes, respectively. Diode gate CR113 and a feedback circuit convert the three binaries into a decimal counting circuit. Diodes CR110 and CR111 determine the weighting of the four-line code. With the code control

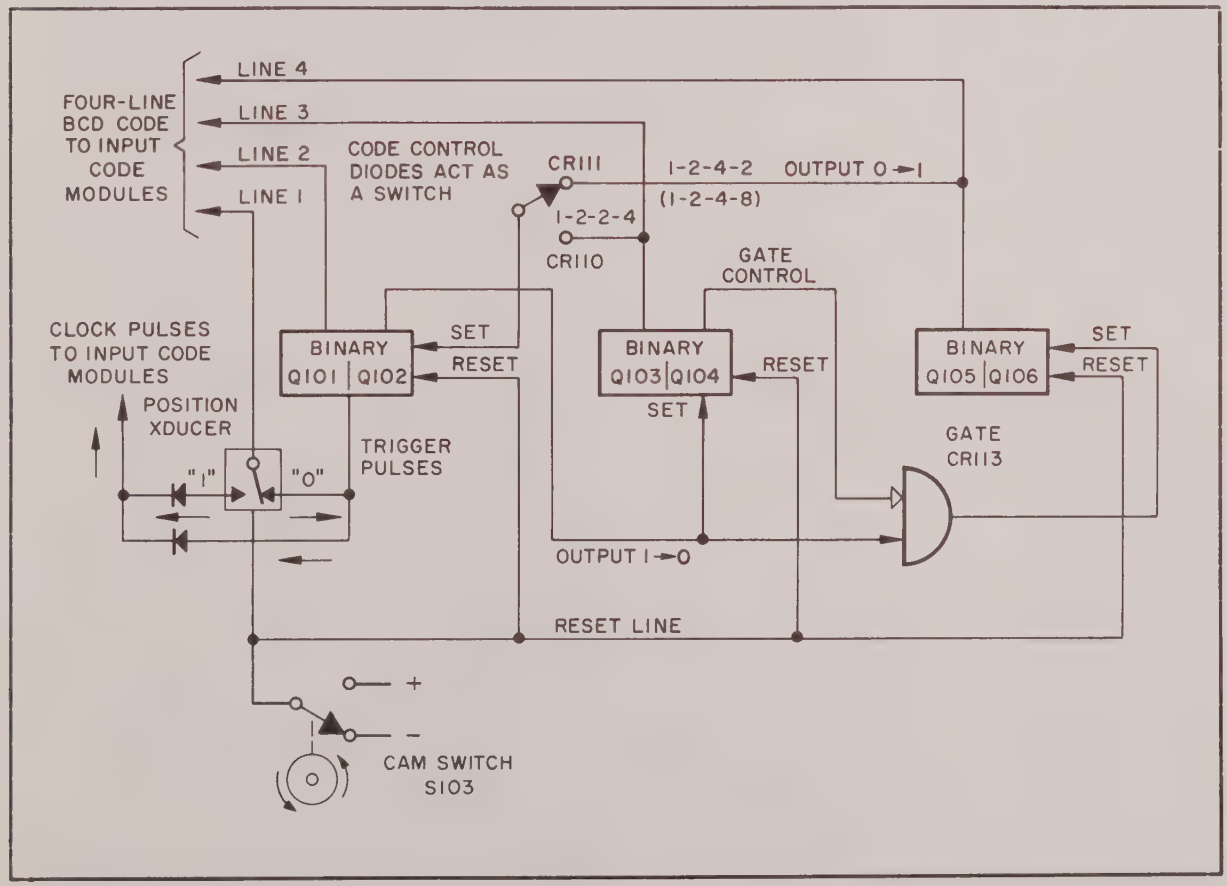


FIG. 3-3. Code Generator.

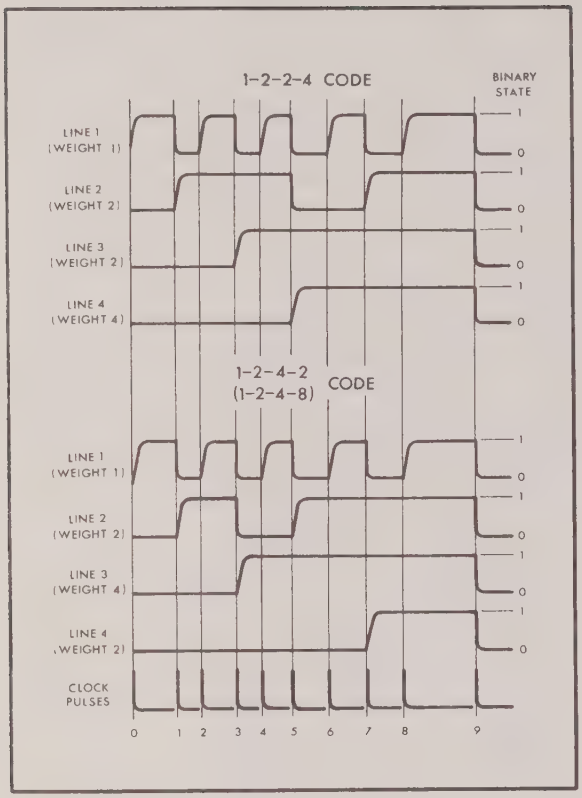


FIG. 3-4. BCD outputs of the Code Generator.

line ungrounded, CR111 switches the loop from Q105 to Q102, changing the weighting to 1-2-4-2, for either 1-2-4-2 or 1-2-4-8 input code (both weights are the same in the Model 1453 logic).

3.4.2 The Binary Circuit

A typical binary stage in the code generator consists of a pair of P-N-P transistor amplifiers with the collectors and bases cross-coupled. Being symmetrical, the circuit can exist in either of two stable states (one transistor on, the other off, or vice versa). Figure 3-5 shows one binary and explains how positive pulses from the position transducer switch the circuit from one stable state to the other.

3.5 INPUT CODE MODULE

3.5.1 General Design Features

Two kinds of input code modules are available for the Model 1453: a four-line module for BCD data of 1-2-2-4, 1-2-4-2, and 1-2-4-8 weighting, and a ten-line module which accepts both ten-line and four-line data. Both 1-2-4-2 and 1-2-4-8 code weights are the same for the Model 1453. Each module plugs into any of twelve sockets, numbered 1 through 12, which correspond to the positions of the digit columns. A maximum of twelve digits of coded data can be plugged into the modules in any order. By connecting the individually numbered connectors on the input cable to a particular module, the digits can be arranged in any order on the printed line.

3.5.2 Four-Line Input Code Module

The input code module is a solid-state device comprising a coincidence comparator (CR201-CR208), a two-stage trigger circuit (Q201, Q203), and a pawl magnet driver (Q202). See Fig. 3-6.

Clock pulses generated for each position of the type bar assembly are applied to the trigger circuit through an attenuator. The attenuation factor is high when any coincidence diode (CR201, CR203, CR206, or CR208) is conducting, and low when all four diodes are non-conducting. Four lines of BCD data are applied to the anodes of the diodes from the external input source; four lines of similarly coded data are applied to the cathodes from the code generator. As long as the decimal digits represented by the two data sources are different, at least one of the diodes will conduct. Therefore, the clock pulses are attenuated to about +5 volts—too low to affect the trigger circuit. During this quiescent condition, the trigger is in RESET, keeping Q202 on. Since the collector of Q202 is returned to

-14 volts through the pawl magnet, the magnet is energized and the stop pawl is held clear of the type bar.

When input data and position data coincide, all four diodes are non-conducting. A clock pulse arriving at coincidence has enough amplitude to switch the trigger circuit to its other stable state, turning off Q202 and allowing the stop pawl to drop. During the restoring part of the printing cycle, a contact closure in the cam switch resets the trigger, turning Q202 on and restoring the holding current in the pawl magnet.

Each input module supplies holding current to its corresponding pawl magnet. Removing the module de-energizes the magnet. Therefore, when the mechanical lock on the magnet armature releases at the beginning of a printing cycle, the stop pawl of any de-energized magnet drops, latching its type bar in the "no print" position. This column suppression feature automatically ensures that no data will be recorded in any digit column that does not have an input module. Column suppression can also be controlled remotely by a contact closure to power ground from one pin on the top connector of any module.

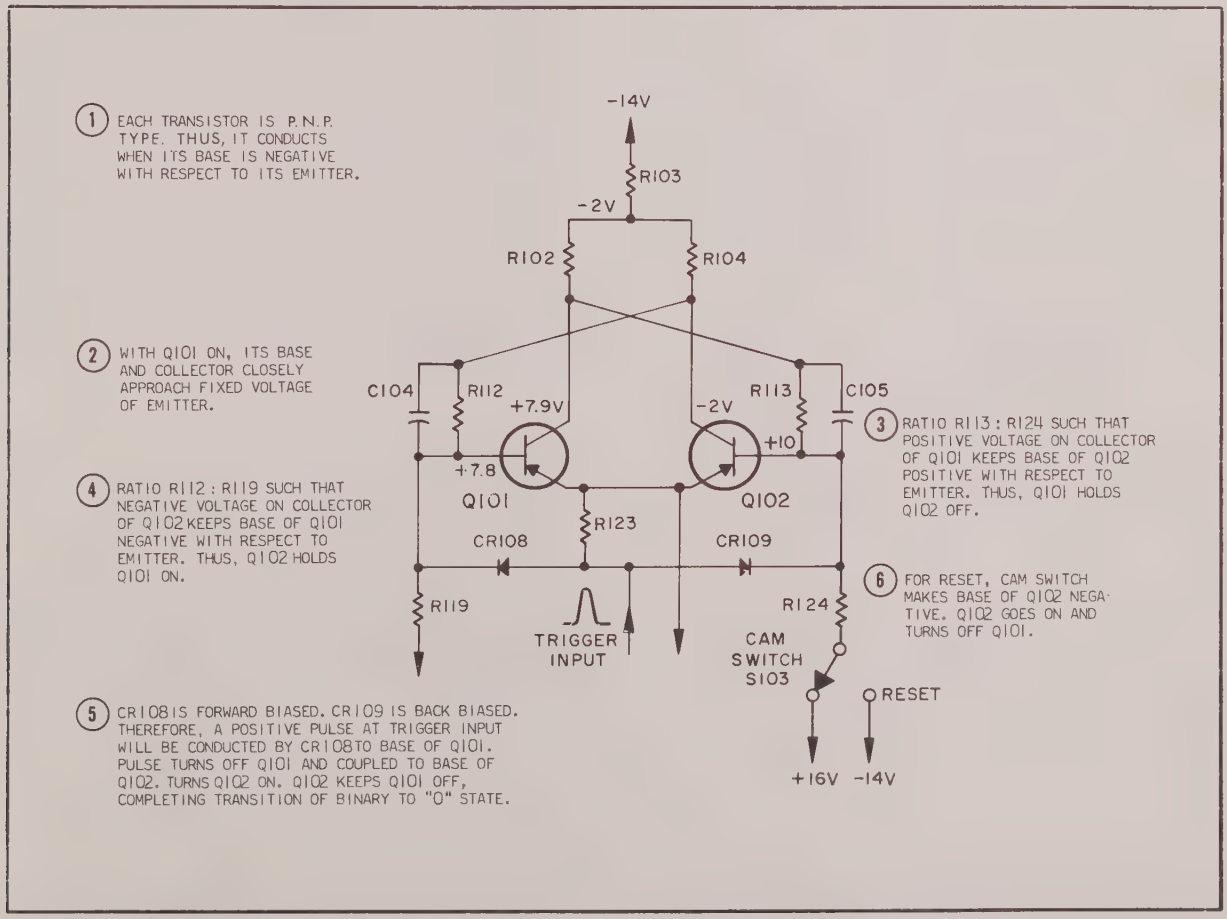

1 EACH TRANSISTOR IS P.N.P. TYPE. THUS, IT CONDUCTS WHEN ITS BASE IS NEGATIVE WITH RESPECT TO ITS EMITTER.
2 WITH Q101 ON, ITS BASE AND COLLECTOR CLOSELY APPROACH FIXED VOLTAGE OF EMITTER.
3 RATIO R113 : R124 SUCH THAT POSITIVE VOLTAGE ON COLLECTOR OF Q101 KEEPS BASE OF Q102 POSITIVE WITH RESPECT TO EMITTER. THUS, Q101 HOLDS Q102 OFF.
4 RATIO R112 : R119 SUCH THAT NEGATIVE VOLTAGE ON COLLECTOR OF Q102 KEEPS BASE OF Q101 NEGATIVE WITH RESPECT TO EMITTER. THUS, Q102 HOLDS Q101 ON.
5 CR108 IS FORWARD BIASED. CR109 IS BACK BIASED. THEREFORE, A POSITIVE PULSE AT TRIGGER INPUT WILL BE CONDUCTED BY CR108 TO BASE OF Q101. PULSE TURNS OFF Q101 AND COUPLED TO BASE OF Q102. TURNS Q102 ON. Q102 KEEPS Q101 OFF, COMPLETING TRANSITION OF BINARY TO "0" STATE.
6 FOR RESET, CAM SWITCH MAKES BASE OF Q102 NEGATIVE. Q102 GOES ON AND TURNS OFF Q101.
-14V
R103
-2V
R102
R104
C104
R112
+7.9V
-2V
R113
C105
+10
+7.8
Q101
Q102
R123
CR108
CR109
R119
R124
TRIGGER INPUT
CAM SWITCH S103
RESET
+16V
-14V

FIG. 3-5. A typical binary in the Code Generator. Circuit is shown in the "1" state.

Grounding this pin turns Q202 off, allowing the stop pawl to drop when the reset signal is removed at the beginning of the cycle.

3.5.3 Ten-Line Input Code Module

The ten-line input code module uses a diode matrix which first translates the decimal input data into four-line BCD data, weighted 1-2-2-4 or 1-2-4-8 according to the position of a switch on the module. The remaining circuit is the same as that of the four-line module.

Since the ten-line module accepts both ten-line data and BCD data, a printer fitted with these modules is able to record both types of information on one line.

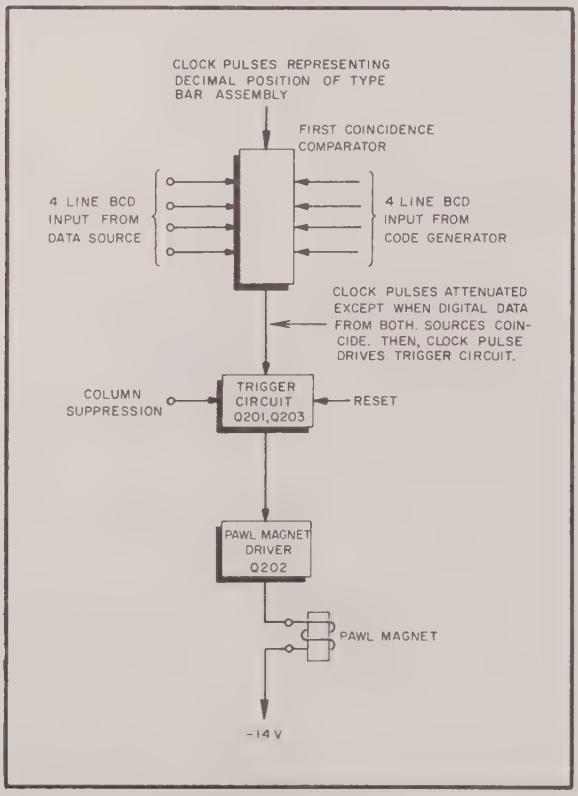

CLOCK PULSES REPRESENTING DECIMAL POSITION OF TYPE BAR ASSEMBLY
FIRST COINCIDENCE COMPARATOR
4 LINE BCD INPUT FROM DATA SOURCE
4 LINE BCD INPUT FROM CODE GENERATOR
CLOCK PULSES ATTENUATED EXCEPT WHEN DIGITAL DATA FROM BOTH SOURCES COINCIDE. THEN, CLOCK PULSE DRIVES TRIGGER CIRCUIT.
COLUMN SUPPRESSION
TRIGGER CIRCUIT Q201,Q203
RESET
PAWL MAGNET DRIVER Q202
PAWL MAGNET
-14 V

FIG. 3-6. Logic diagram of the four-line input code module.

3.6 CONTROL CIRCUIT

3.6.1 Design of the Control Circuit

The control circuit responds to the print and color control commands to select the color of the impression and start the printing cycle. Both commands are applied to a control trigger circuit (V101, Q107) which drives a clutch actuating circuit (Q108, K103) and a color selector (K102). Interference between clutch control and color control is avoided by the timing sequence of the two functions, as described in paragraph 3.6.3.

3.6.2 Control Trigger Circuit

The control trigger circuit comprises a cathode follower (V101A) and a trigger stage (V101B, Q107). (See Figures 3-7 and 3-8.) This circuit serves two purposes. First, it presents a high input impedance to the external control signals (print command and color control command) and a low output impedance to the printer's solid-state circuits. Next, it responds only when the voltage on the print command line drops below a set triggering level (about -8 volts) for a period long enough to operate the clutch actuator.

3.6.3 Control Logic

Steps 1 through 12 of the following paragraphs outline a complete cycle of printer operation. These steps are related to the circled numbers in Figure 3-9, to each mechanical drawing (Figures 3-10 through 3-30), and to the Timing Diagram on page 5-4a.

STEPS FOR COMPLETE CYCLE OF PRINTER OPERATION

(1) In READY state, i.e., before a print command, clutch actuator K103 is de-energized. The motor is running with clutch disengaged. Printer mechanism is at rest.

② A print command passes through contact A of K103 to control trigger, which generates a 28 volt positive output step.

③ Transformer T102 differentiates 28 volt step, producing a positive pulse at end A and a negative pulse at end B.

④ With print switch S102 at PRINT, diode CR117 conducts, returning base of Q108 to ground through contact C of K103. Q108 turns on. Collector current then flows, energizing K103. When armature of K103 moves, it releases a mechanical trip that engages the clutch. The cam shaft then begins to rotate.

⑤ Contact D of K103 closes. K103 is then latched through resistor R149. (K103 is now independent of Q108.)

⑥ As armature of K103 continues its travel, contact C breaks ground return to base of Q108, turning off Q108. Subsequent operation of control trigger circuit during color control sequence will not affect clutch control circuit.

⑦ Contact B of K103 closes, grounding inhibit reset line. This inhibit reset command prevents reset of data source before data entry is complete.

⑧ Contact A of K103 opens, disconnecting print command line from control trigger circuit. Trigger circuit is then available for color control function.

⑨ The color printed is determined by amount of travel of ribbon shift mechanism, which moves either the red or black portion of ribbon into a position between type face and paper for printing operation. To print red, ribbon guides are permitted full travel. To print black, movement is restricted by linkages operated manually from front-panel RED/BLACK lever, or electrically by color selector K102.

To select color electrically, set front-panel lever at RED. Then, with binary 1 (0 to +50 volts) on color control line, output of control trigger circuit should be -28 volts (see Figure 3-8). Thus, K102 de-energizes and red will be printed. With binary 0 (-12 to -50 volts) on color control line, K102 energizes and black is printed.

NOTE

Relay K102, energized by initial print command, remains energized after contact A of K103 opens (step 8). K102 remains energized because control trigger input is held negative via R150 which connects to -14 volts through contact A of cam switch S103. After cam shaft rotation opens S103A, control trigger input voltage rises because R150 connects to +16 volts through R121. At that time, K102 de-energizes unless a "print black" signal is present on the color control line.

⑩ When data entry is complete—about halfway through the mechanical cycle—S103A closes again, but the change from ground to negative at control trigger input does not affect the clutch actuator, since contact C of K103 is still open (see step 3).

⑪ Aligner arm locks type bars in their selected positions, at same time pressing armature of K103 into de-energized position, unlatching K103. The control circuit is then able to again accept a print command, and the external source is free to provide new data. However, the clutch remains engaged until the end of the cycle, at which time data printing is complete and type bars have been restored to their starting position.

Since the input to the control trigger circuit is already held negative through R150 and S103A, closing K103A cannot produce a false print command. The input needs to reach ground level or above and then drop below triggering level before clutch control circuit responds.

⑫ If a new print command arrives before the cycle is complete, the mechanism does not stop at end of cycle. Instead, command will trigger clutch actuator so that clutch remains engaged.

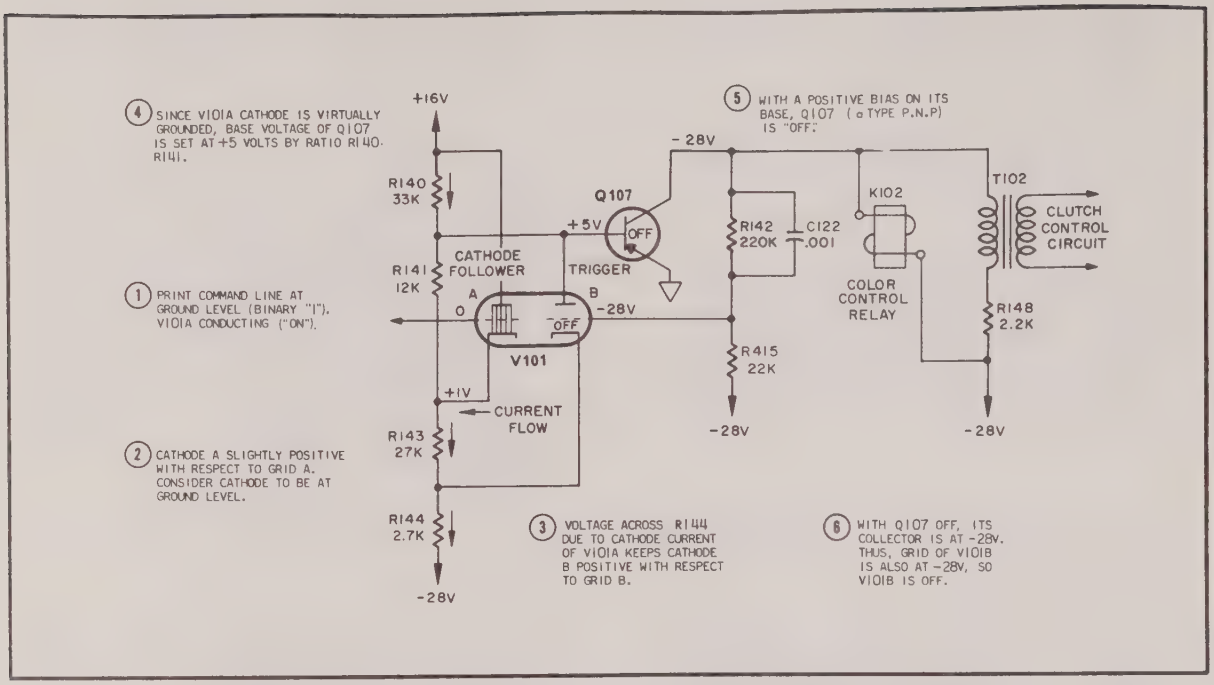

4 SINCE V101A CATHODE IS VIRTUALLY GROUNDED, BASE VOLTAGE OF Q107 IS SET AT +5 VOLTS BY RATIO R140-R141.
1 PRINT COMMAND LINE AT GROUND LEVEL (BINARY "1"). V101A CONDUCTING ("ON").
2 CATHODE A SLIGHTLY POSITIVE WITH RESPECT TO GRID A. CONSIDER CATHODE TO BE AT GROUND LEVEL.
+16V
R140 33K
R141 12K
CATHODE FOLLOWER
A
B
0
-28V
OFF
V101
+1V
CURRENT FLOW
R143 27K
R144 2.7K
-28V
Q107
+5V
OFF
TRIGGER
5 WITH A POSITIVE BIAS ON ITS BASE, Q107 (a TYPE P.N.P) IS "OFF."
-28V
R142 220K
C122 .001
R415 22K
-28V
K102
COLOR CONTROL RELAY
T102
CLUTCH CONTROL CIRCUIT
R148 2.2K
-28V
3 VOLTAGE ACROSS R144 DUE TO CATHODE CURRENT OF V101A KEEPS CATHODE B POSITIVE WITH RESPECT TO GRID B.
6 WITH Q107 OFF, ITS COLLECTOR IS AT -28V. THUS, GRID OF V101B IS ALSO AT -28V, SO V101B IS OFF.

FIG. 3-7. Quiescent (Reset) state of the control trigger circuit.

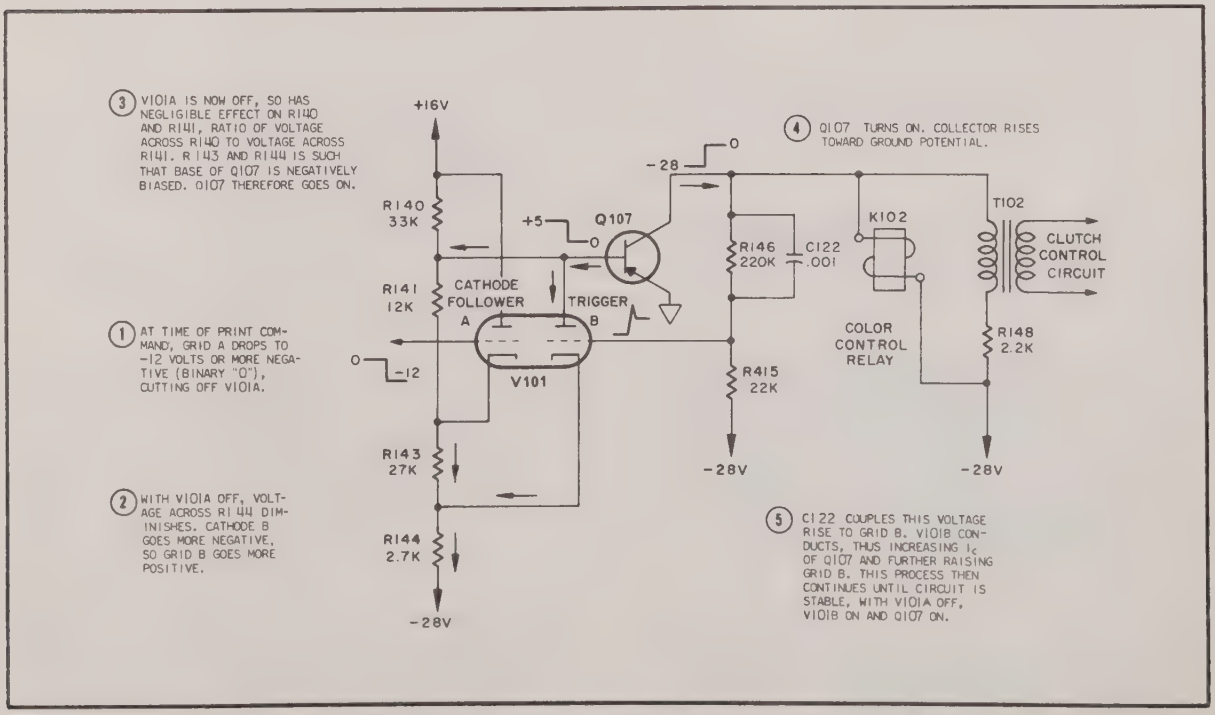

3 V101A IS NOW OFF, SO HAS NEGLIGIBLE EFFECT ON R140 AND R141, RATIO OF VOLTAGE ACROSS R140 TO VOLTAGE ACROSS R141. R143 AND R144 IS SUCH THAT BASE OF Q107 IS NEGATIVELY BIASED. Q107 THEREFORE GOES ON.
1 AT TIME OF PRINT COMMAND, GRID A DROPS TO -12 VOLTS OR MORE NEGATIVE (BINARY "0"), CUTTING OFF V101A.
2 WITH V101A OFF, VOLTAGE ACROSS R144 DIMINISHES. CATHODE B GOES MORE NEGATIVE, SO GRID B GOES MORE POSITIVE.
+16V
R140 33K
R141 12K
CATHODE FOLLOWER
A
B
0
-12
V101
R143 27K
R144 2.7K
-28V
Q107
+5
0
TRIGGER
4 Q107 TURNS ON. COLLECTOR RISES TOWARD GROUND POTENTIAL.
-28
0
R146 220K
C122 .001
R415 22K
-28V
K102
COLOR CONTROL RELAY
T102
CLUTCH CONTROL CIRCUIT
R148 2.2K
-28V
5 C122 COUPLES THIS VOLTAGE RISE TO GRID B. V101B CONDUCTS, THUS INCREASING Ic OF Q107 AND FURTHER RAISING GRID B. THIS PROCESS THEN CONTINUES UNTIL CIRCUIT IS STABLE, WITH V101A OFF, V101B ON AND Q107 ON.

FIG. 3-8. Response of control trigger circuit to a command.

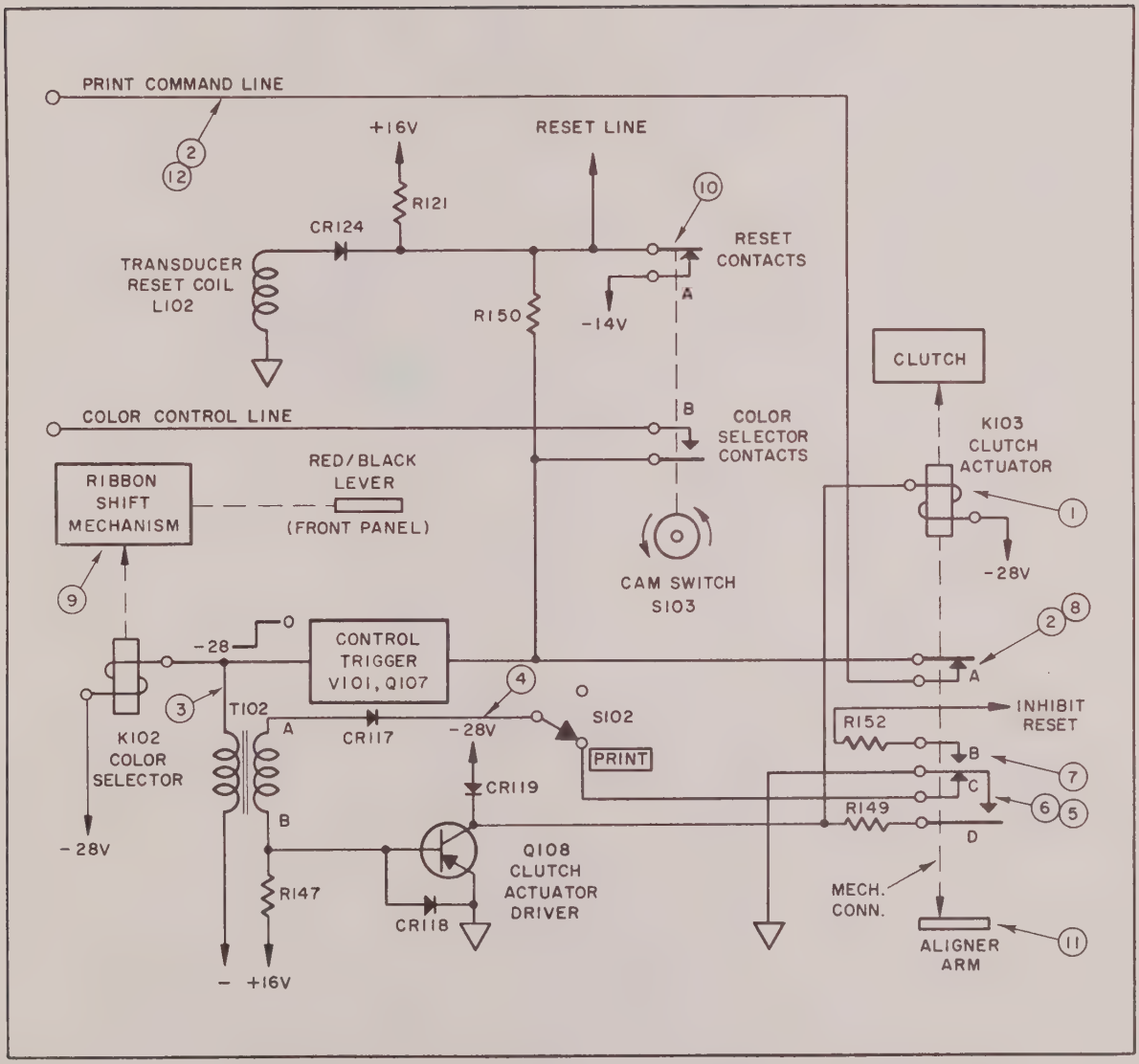


FIG. 3-9. Control circuit, simplified.

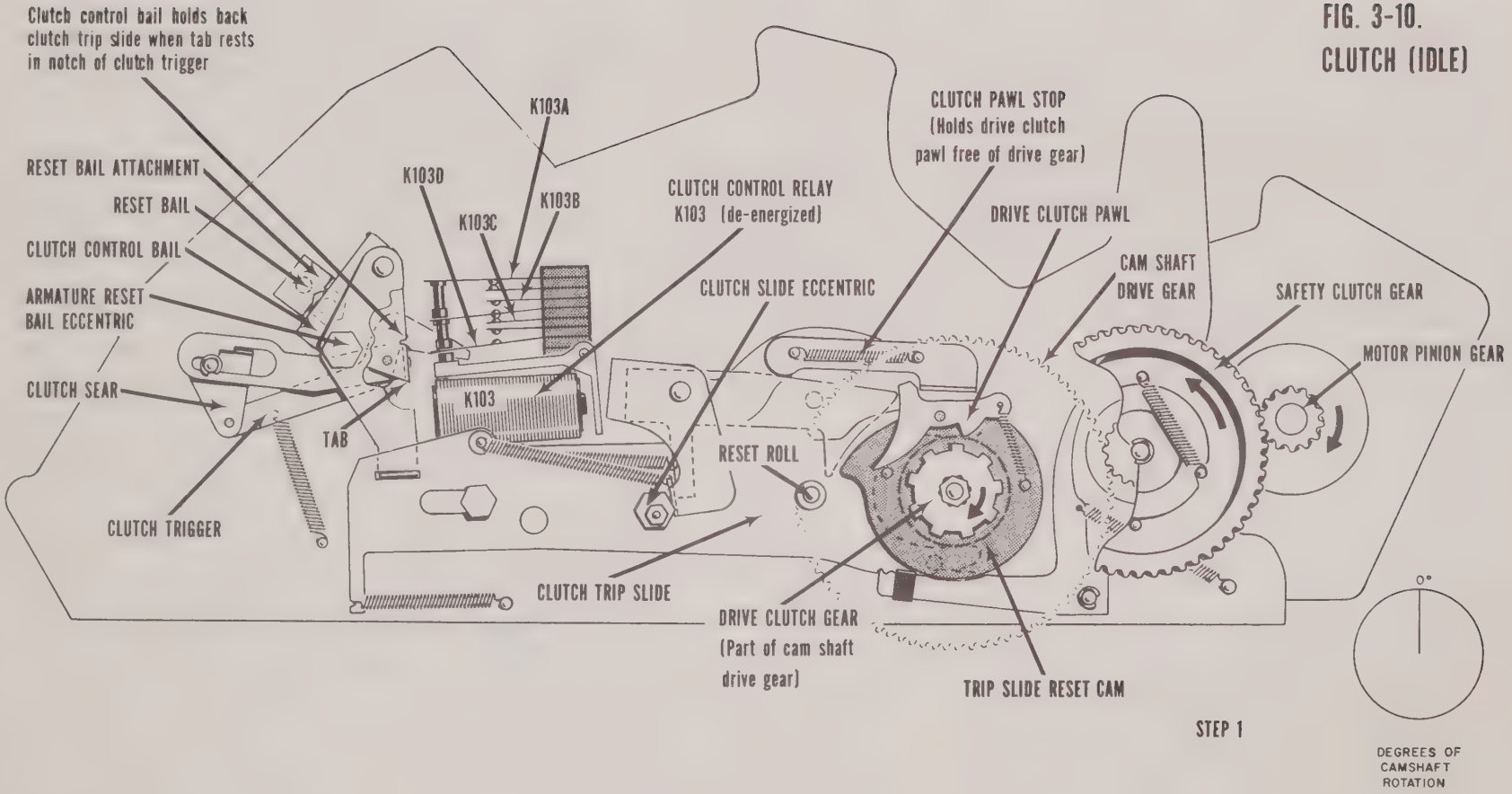


FIG. 3-10.
CLUTCH (IDLE)

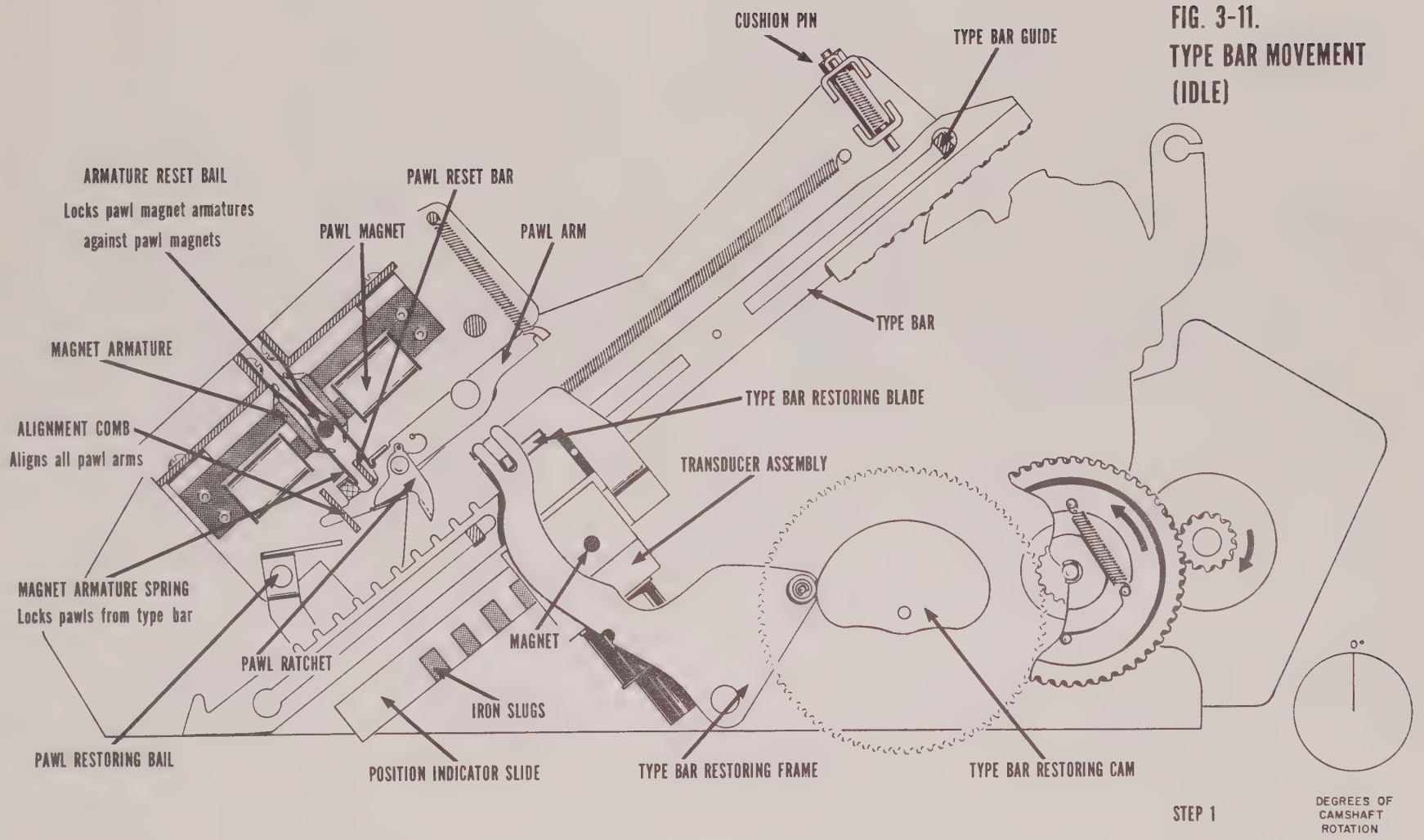


FIG. 3-11.
TYPE BAR MOVEMENT
(IDLE)

FIG. 3-12.
CLUTCH (ENGAGED)

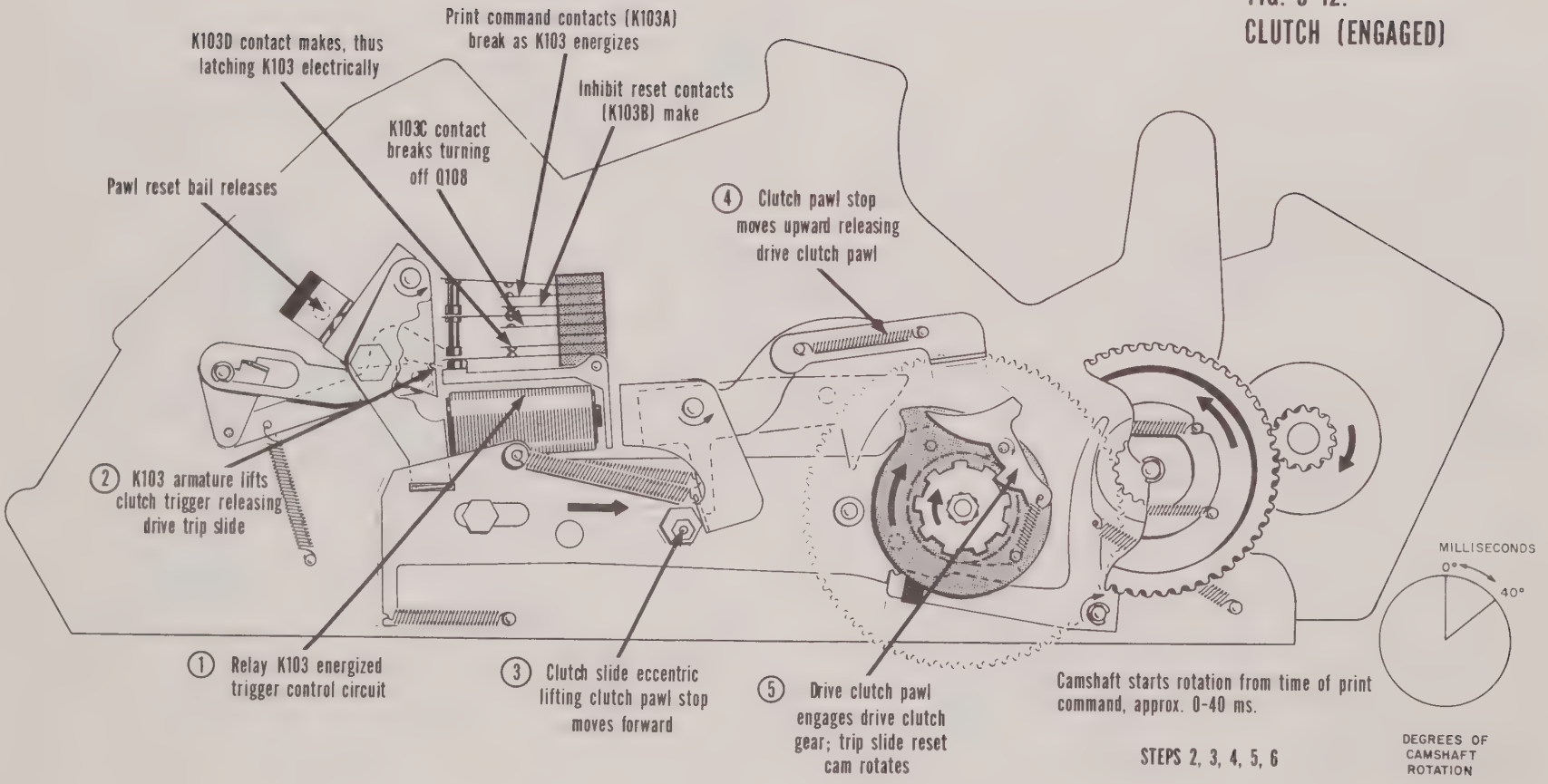

K103D contact makes, thus latching K103 electrically
Print command contacts (K103A) break as K103 energizes
Inhibit reset contacts (K103B) make
K103C contact breaks turning off Q108
Pawl reset bail releases
4 Clutch pawl stop moves upward releasing drive clutch pawl
2 K103 armature lifts clutch trigger releasing drive trip slide
1 Relay K103 energized trigger control circuit
3 Clutch slide eccentric lifting clutch pawl stop moves forward
5 Drive clutch pawl engages drive clutch gear; trip slide reset cam rotates
Camshaft starts rotation from time of print command, approx. 0-40 ms.
STEPS 2, 3, 4, 5, 6
MILLISECONDS
0°
40°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-13
TYPE BAR MOVEMENT (INDEXING) AND PAWL RELEASE

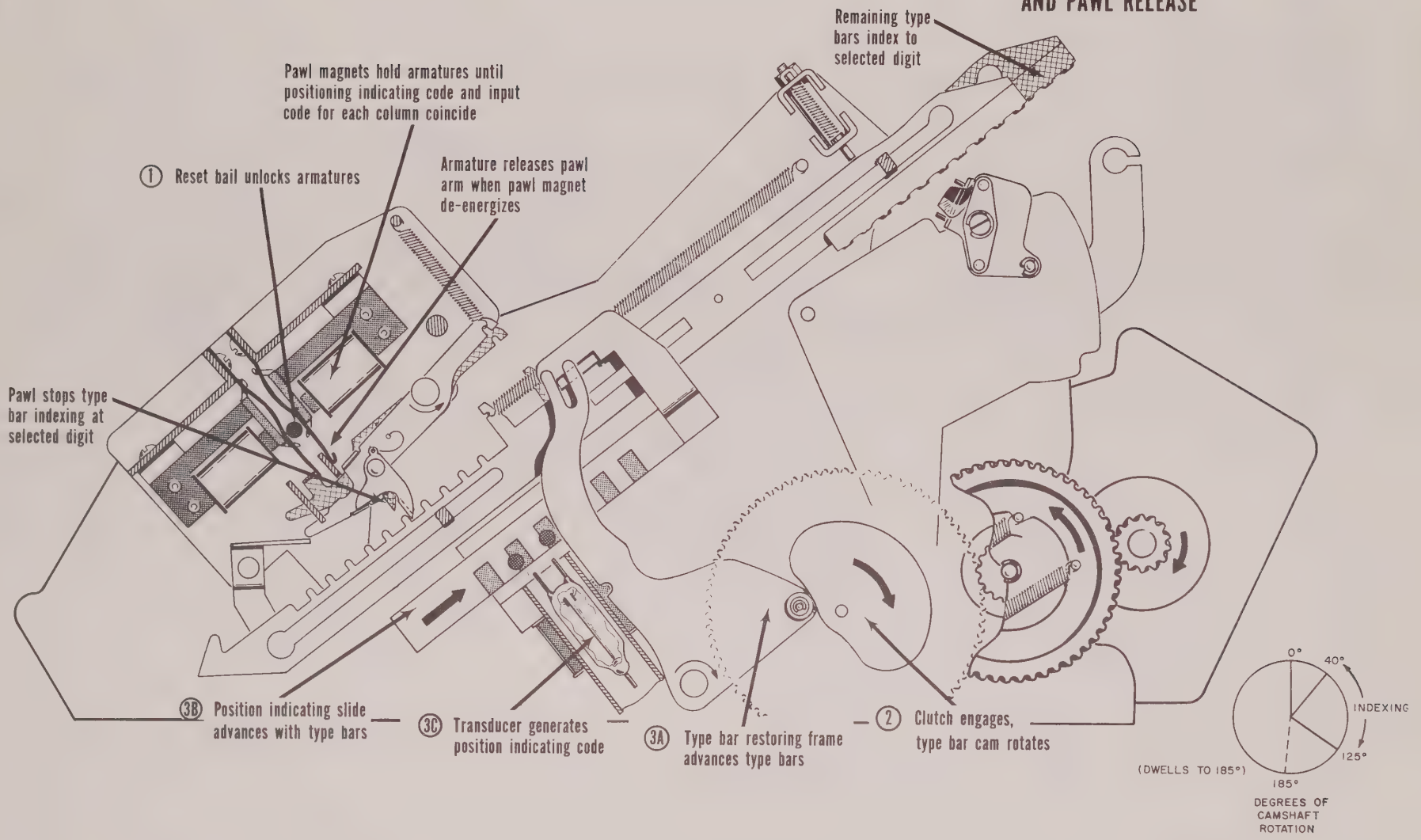
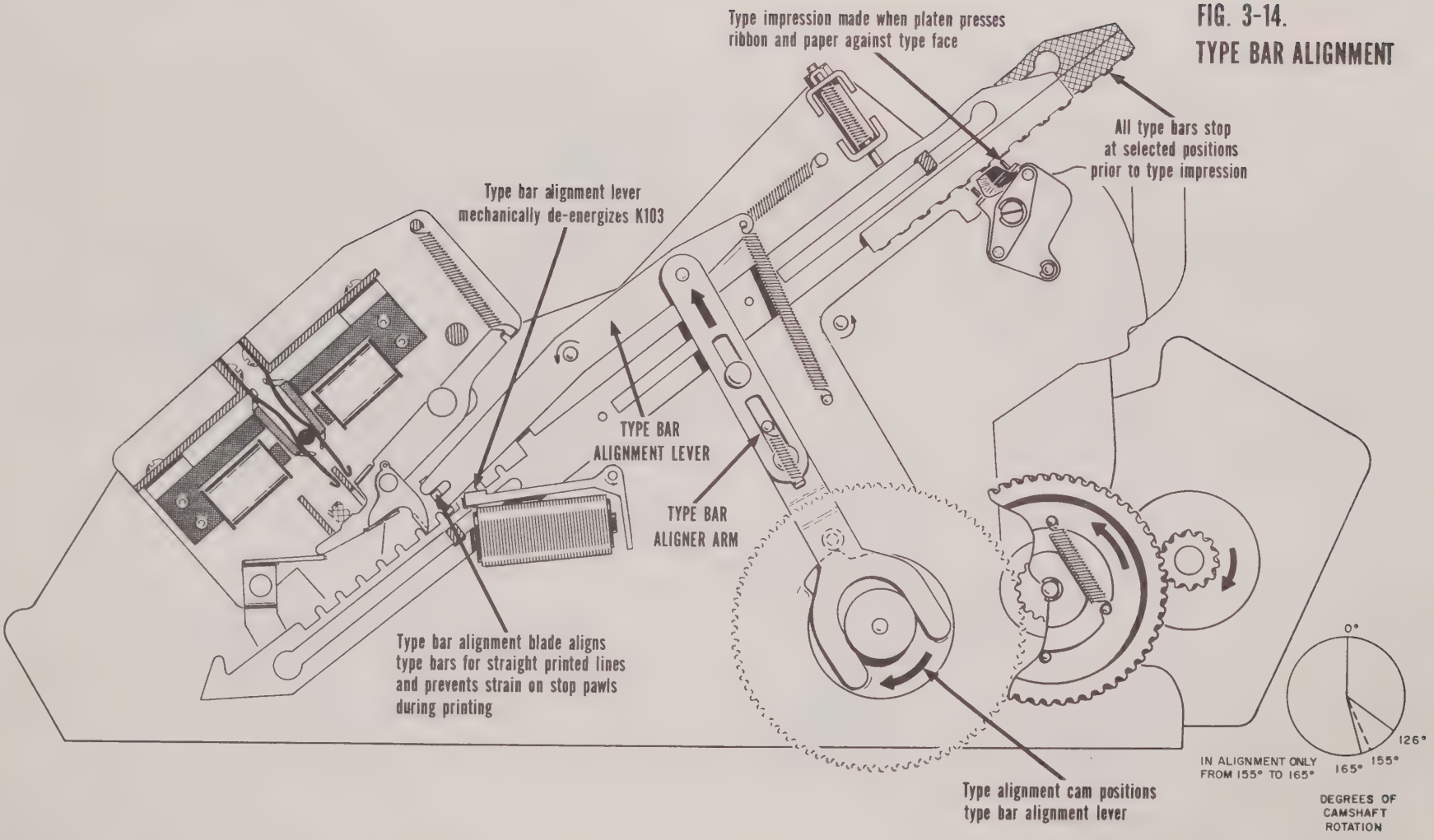

Remaining type bars index to selected digit
Pawl magnets hold armatures until positioning indicating code and input code for each column coincide
① Reset bail unlocks armatures
Armature releases pawl arm when pawl magnet de-energizes
Pawl stops type bar indexing at selected digit
3B Position indicating slide advances with type bars
3C Transducer generates position indicating code
3A Type bar restoring frame advances type bars
② Clutch engages, type bar cam rotates
0°
40°
INDEXING
125°
(DWELLS TO 185°)
185°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-14. TYPE BAR ALIGNMENT


Type impression made when platen presses ribbon and paper against type face
All type bars stop at selected positions prior to type impression
Type bar alignment lever mechanically de-energizes K103
TYPE BAR ALIGNMENT LEVER
TYPE BAR ALIGNER ARM
Type bar alignment blade aligns type bars for straight printed lines and prevents strain on stop pawls during printing
Type alignment cam positions type bar alignment lever
0°
126°
IN ALIGNMENT ONLY FROM 155° TO 165°
165°
155°
DEGREES OF CAMSHAFT ROTATION

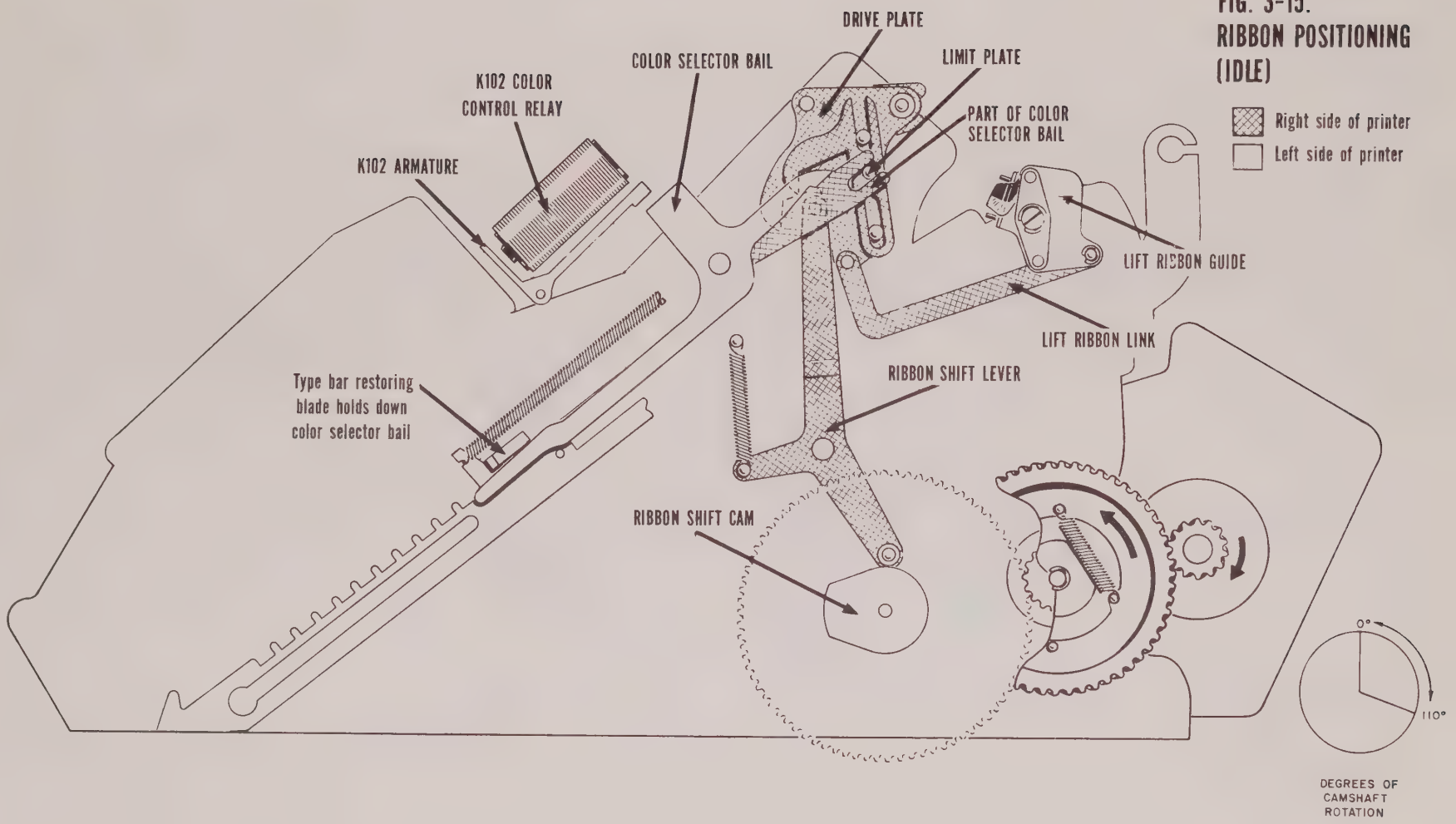


FIG. 3-15.
RIBBON POSITIONING
(IDLE)

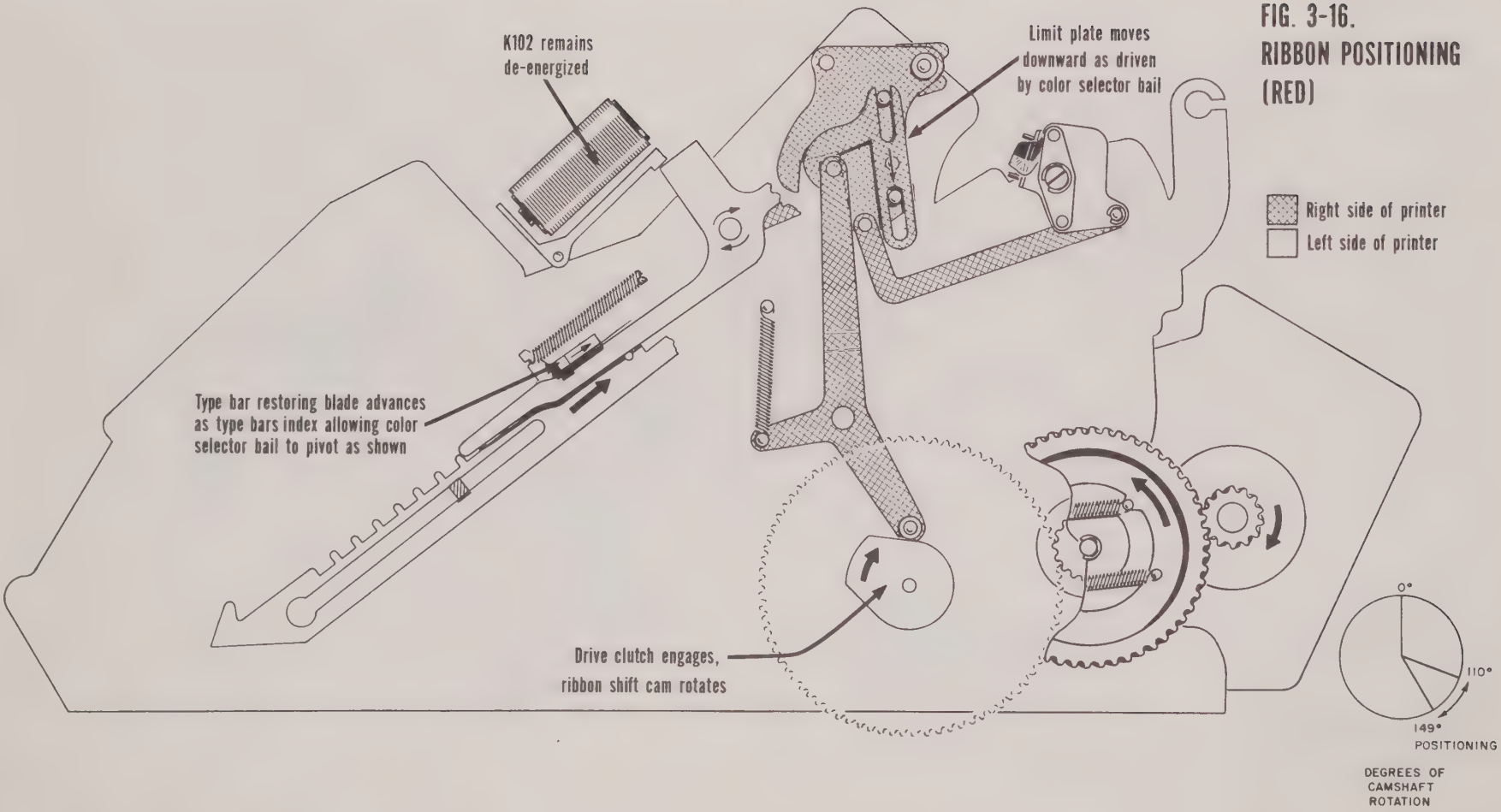


FIG. 3-16.
RIBBON POSITIONING
(RED)

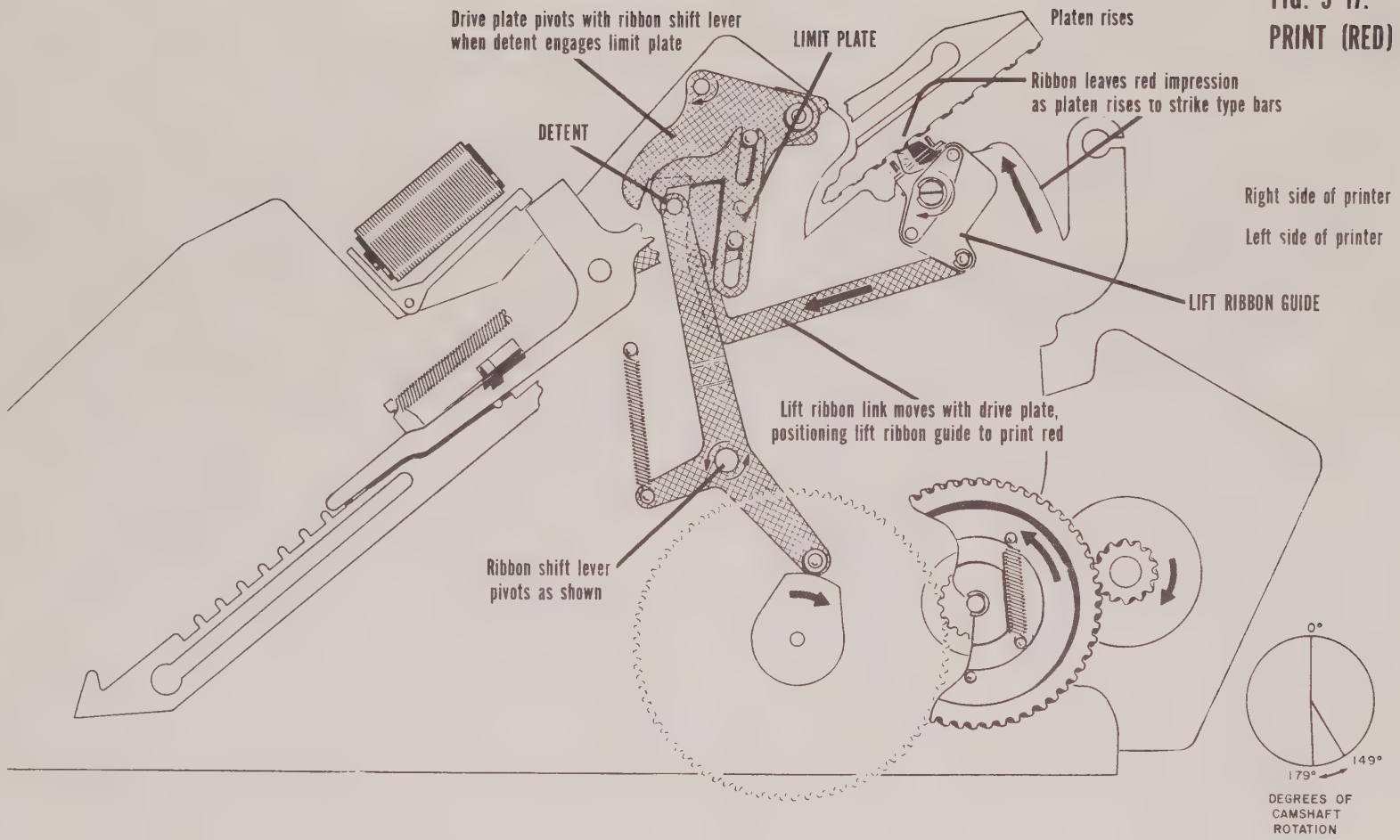

Drive plate pivots with ribbon shift lever when detent engages limit plate
LIMIT PLATE
Platen rises
Ribbon leaves red impression as platen rises to strike type bars
DETENT
Right side of printer
Left side of printer
LIFT RIBBON GUIDE
Lift ribbon link moves with drive plate, positioning lift ribbon guide to print red
Ribbon shift lever pivots as shown
0°
149°
179°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-17.
PRINT (RED)

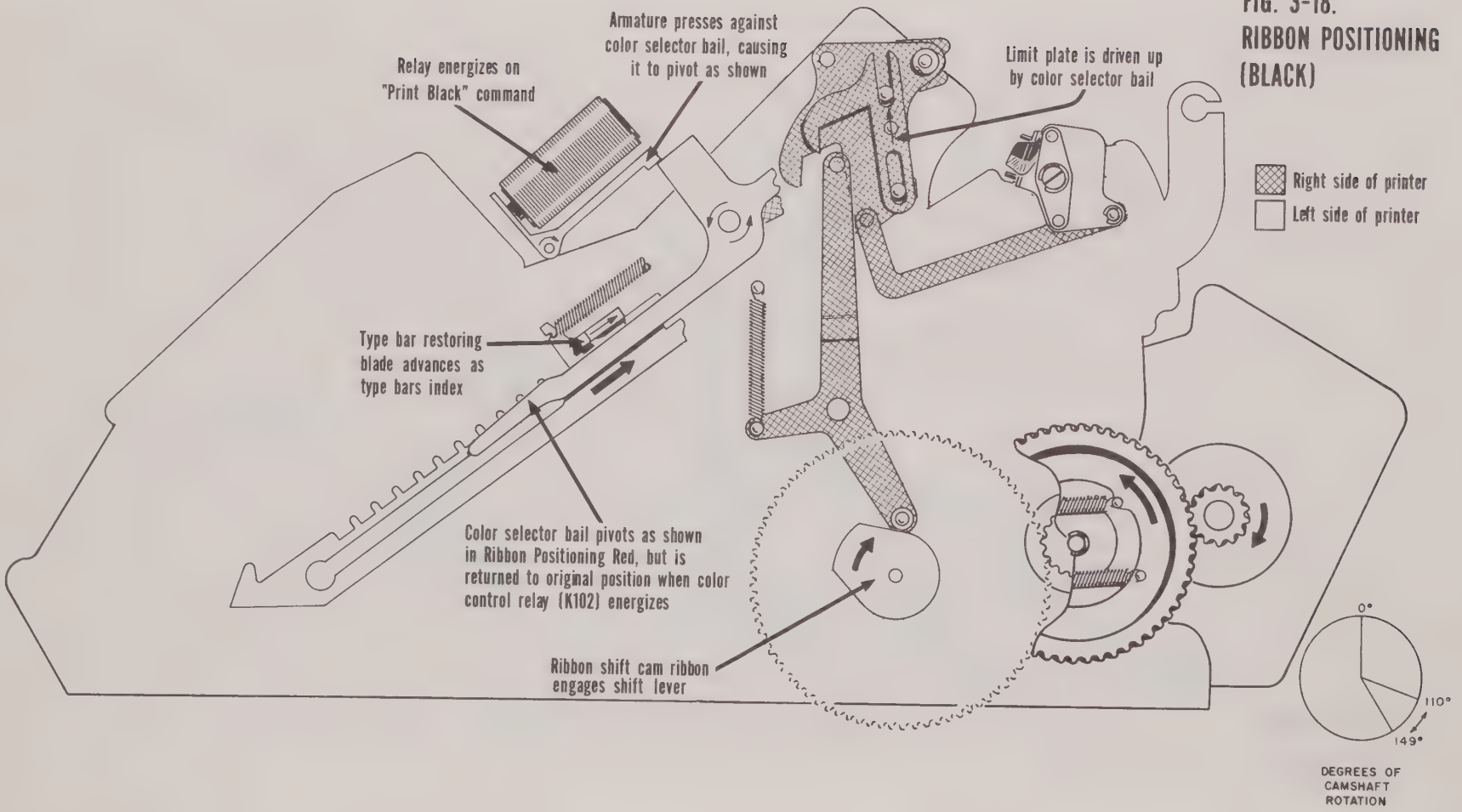

Relay energizes on "Print Black" command
Armature presses against color selector bail, causing it to pivot as shown
Limit plate is driven up by color selector bail
Right side of printer
Left side of printer
Type bar restoring blade advances as type bars index
Color selector bail pivots as shown in Ribbon Positioning Red, but is returned to original position when color control relay (K102) energizes
Ribbon shift cam ribbon engages shift lever
0°
110°
149°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-18.
RIBBON POSITIONING
(BLACK)

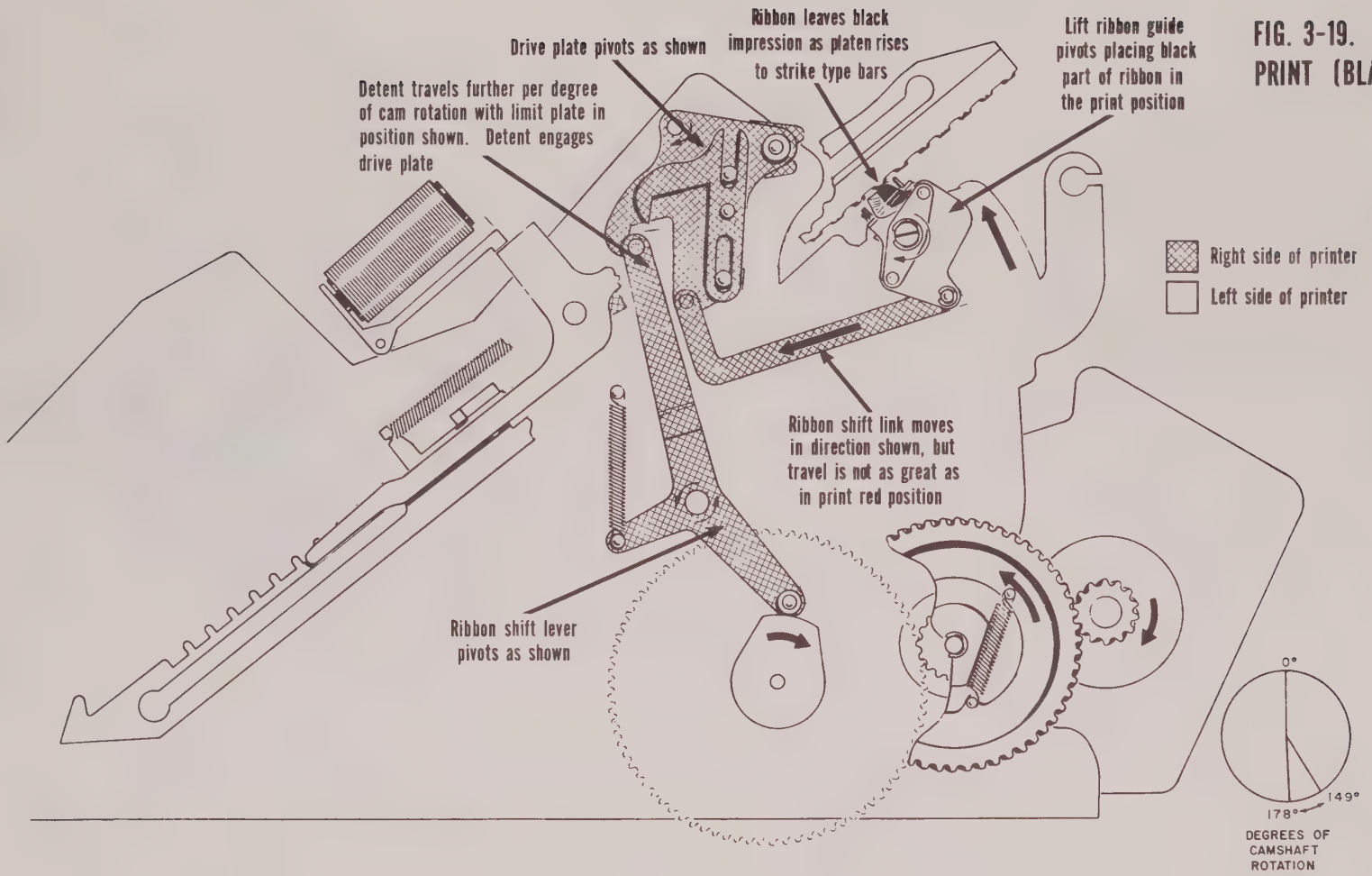

Drive plate pivots as shown
Ribbon leaves black impression as platen rises to strike type bars
Lift ribbon guide pivots placing black part of ribbon in the print position
Detent travels further per degree of cam rotation with limit plate in position shown. Detent engages drive plate
Right side of printer
Left side of printer
Ribbon shift link moves in direction shown, but travel is not as great as in print red position
Ribbon shift lever pivots as shown
0°
149°
178°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-19.
PRINT (BLACK)

FIG. 3-20.
TYPE BAR MOVEMENT
(RESTORING)

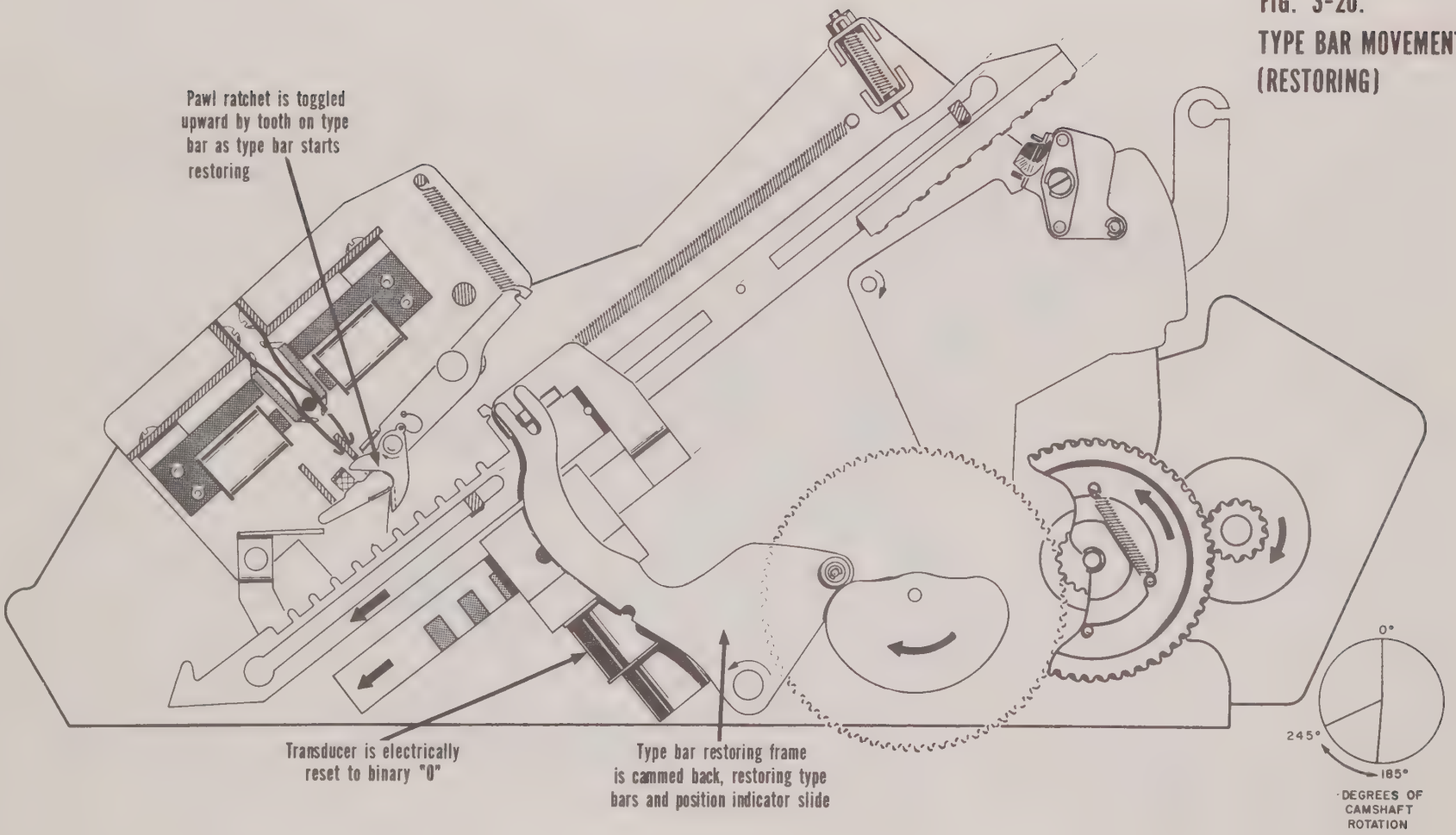

Pawl ratchet is toggled upward by tooth on type bar as type bar starts restoring
Transducer is electrically reset to binary "0"
Type bar restoring frame is cammed back, restoring type bars and position indicator slide
0°
245°
185°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-21.
PAWL RESTORING

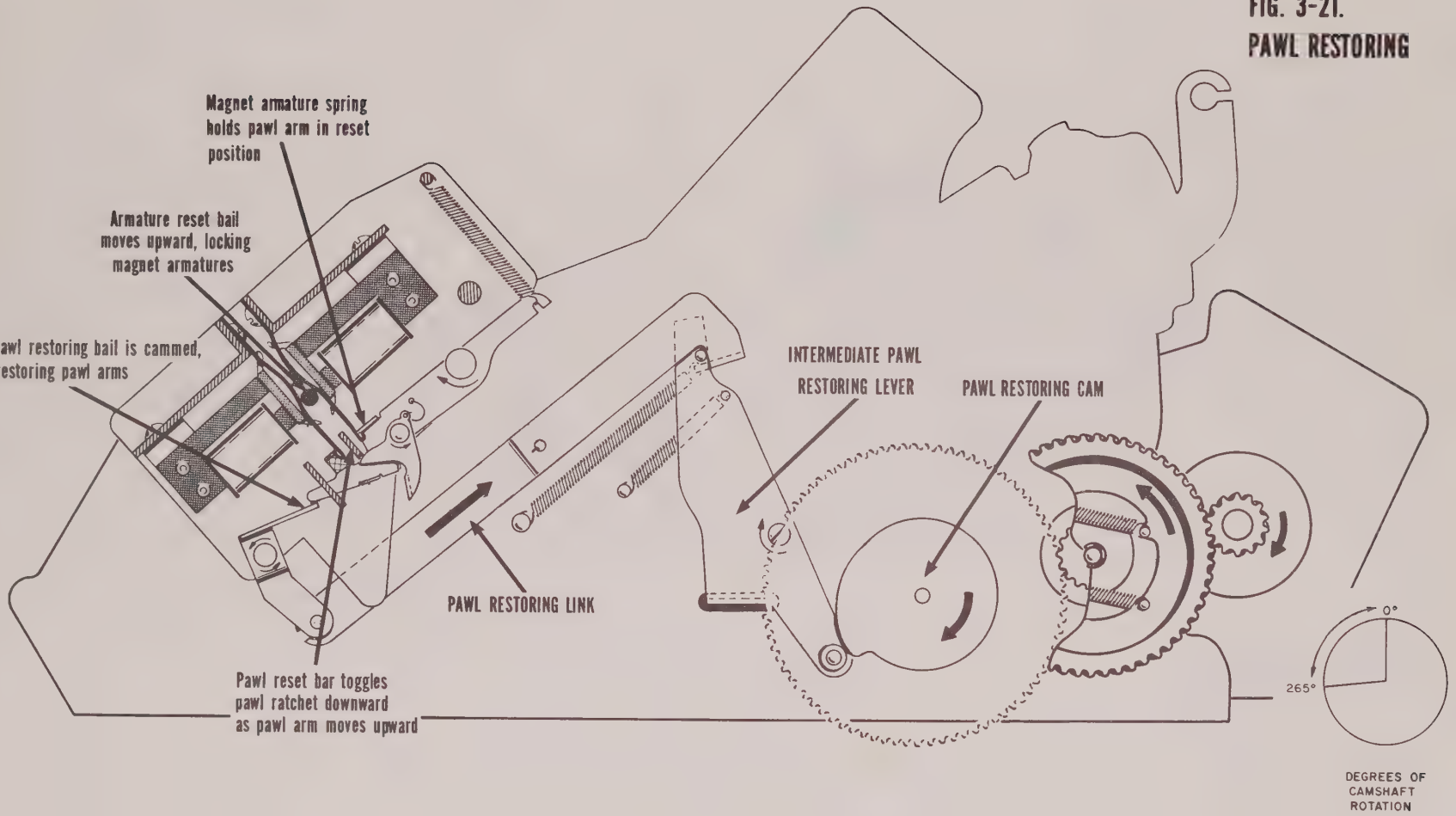

Magnet armature spring holds pawl arm in reset position
Armature reset bail moves upward, locking magnet armatures
Pawl restoring bail is cammed, restoring pawl arms
INTERMEDIATE PAWL RESTORING LEVER
PAWL RESTORING CAM
PAWL RESTORING LINK
Pawl reset bar toggles pawl ratchet downward as pawl arm moves upward
0°
265°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-22.
CLUTCH DISENGAGING

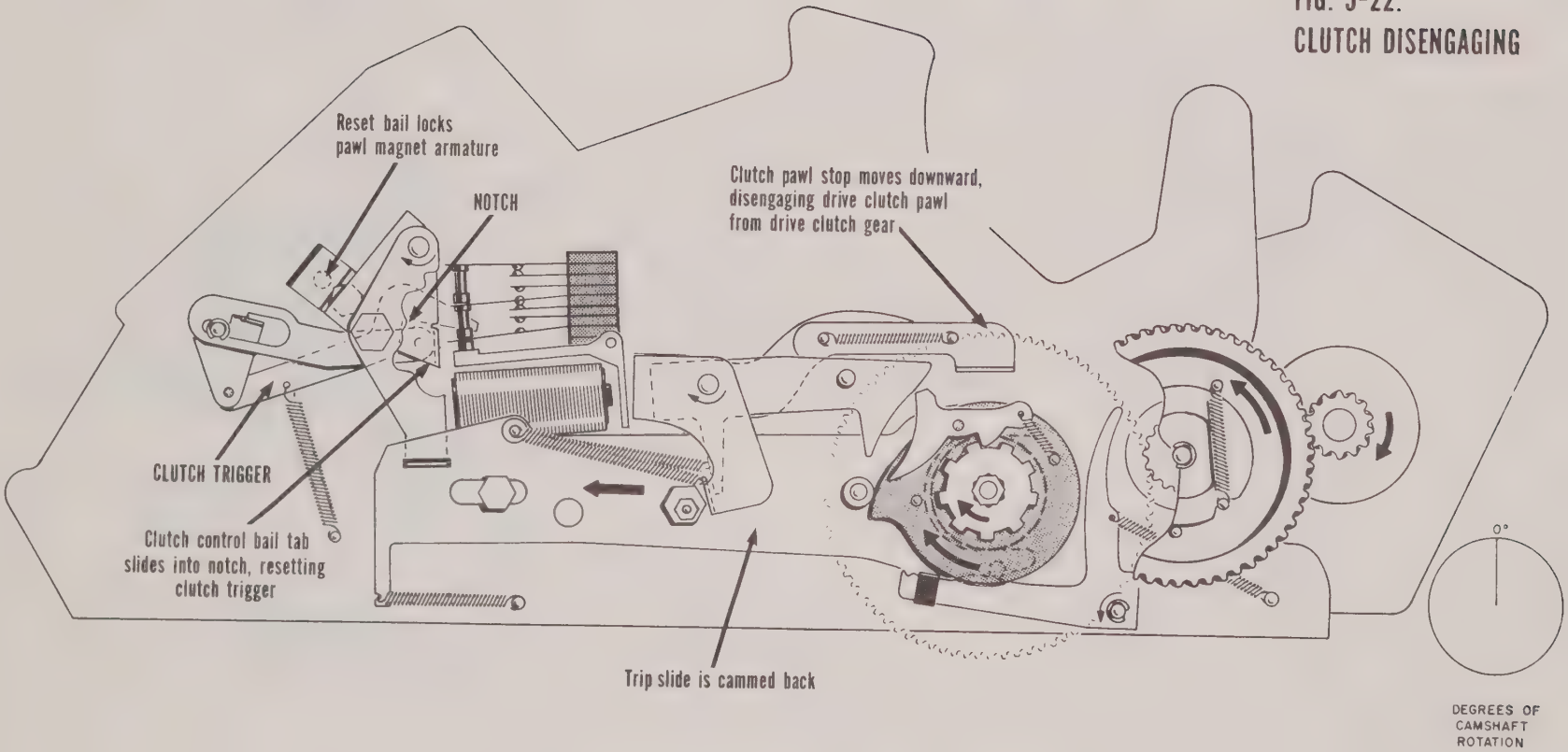

Reset bail locks pawl magnet armature
NOTCH
Clutch pawl stop moves downward, disengaging drive clutch pawl from drive clutch gear
CLUTCH TRIGGER
Clutch control bail tab slides into notch, resetting clutch trigger
Trip slide is cammed back
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-23.
PAPER ADVANCE
(Platen Positioning Upward)

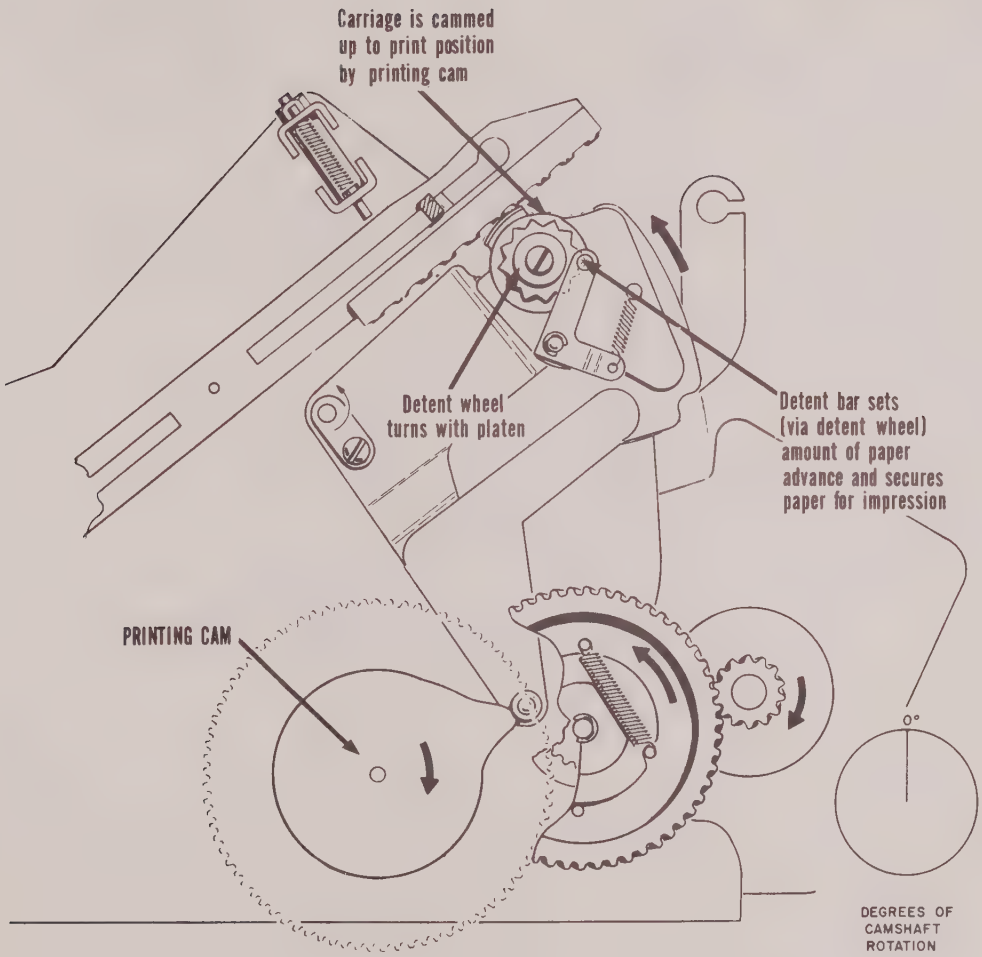

Carriage is cammed up to print position by printing cam
Detent wheel turns with platen
Detent bar sets (via detent wheel) amount of paper advance and secures paper for impression
PRINTING CAM
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-24.
PAPER ADVANCE
(Platen down)

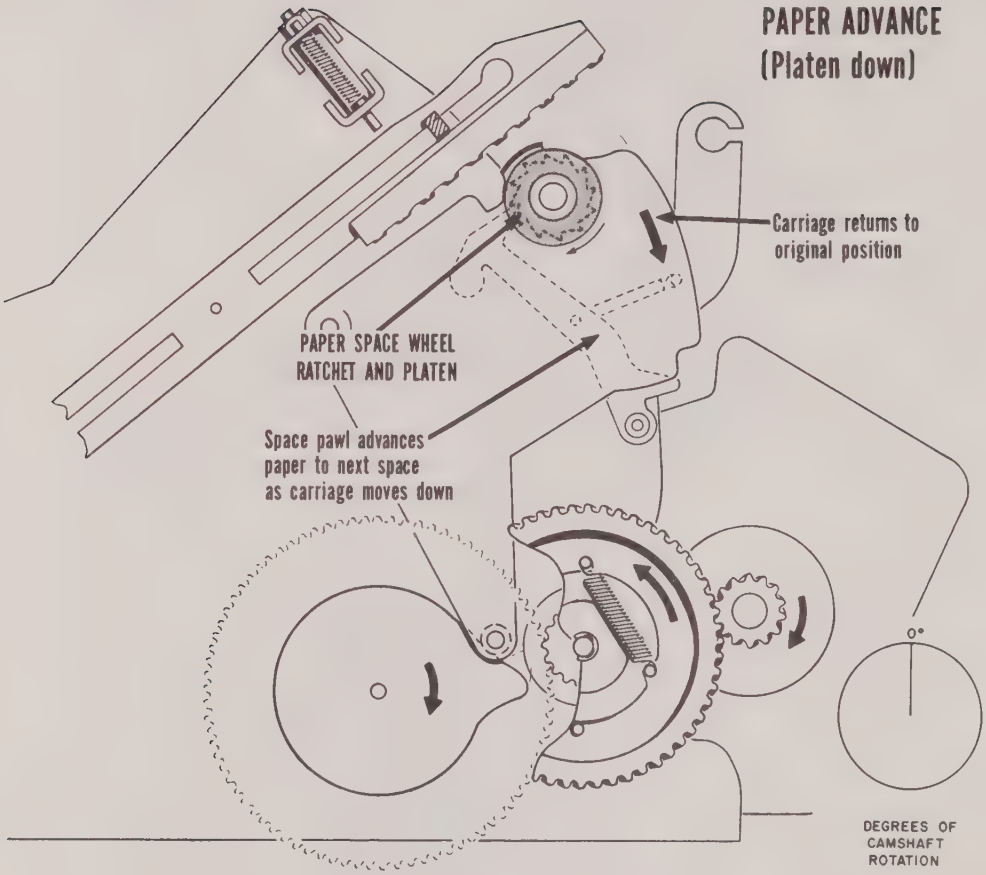

Carriage returns to original position
PAPER SPACE WHEEL RATCHET AND PLATEN
Space pawl advances paper to next space as carriage moves down
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-25.
RIBBON FEED, IDLE
(Left Side Feed)

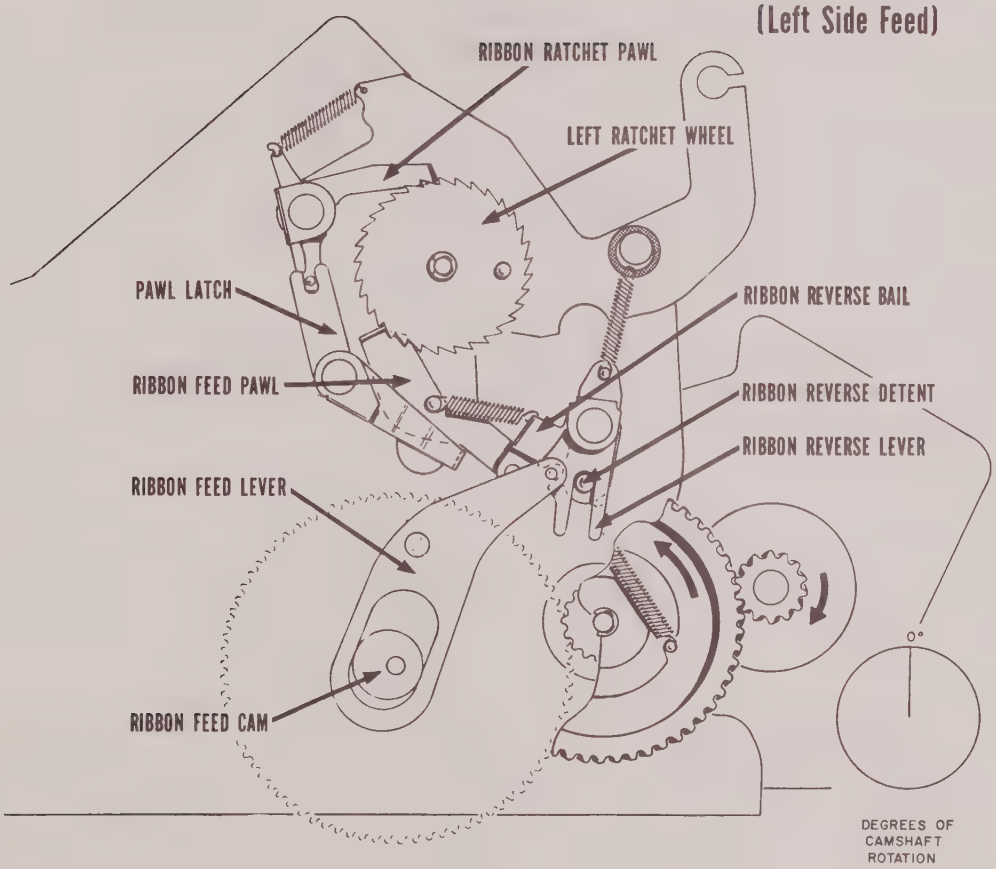


FIG. 3-26.
RIBBON FEED, LEFT SIDE
(Right to Left Side Feed)

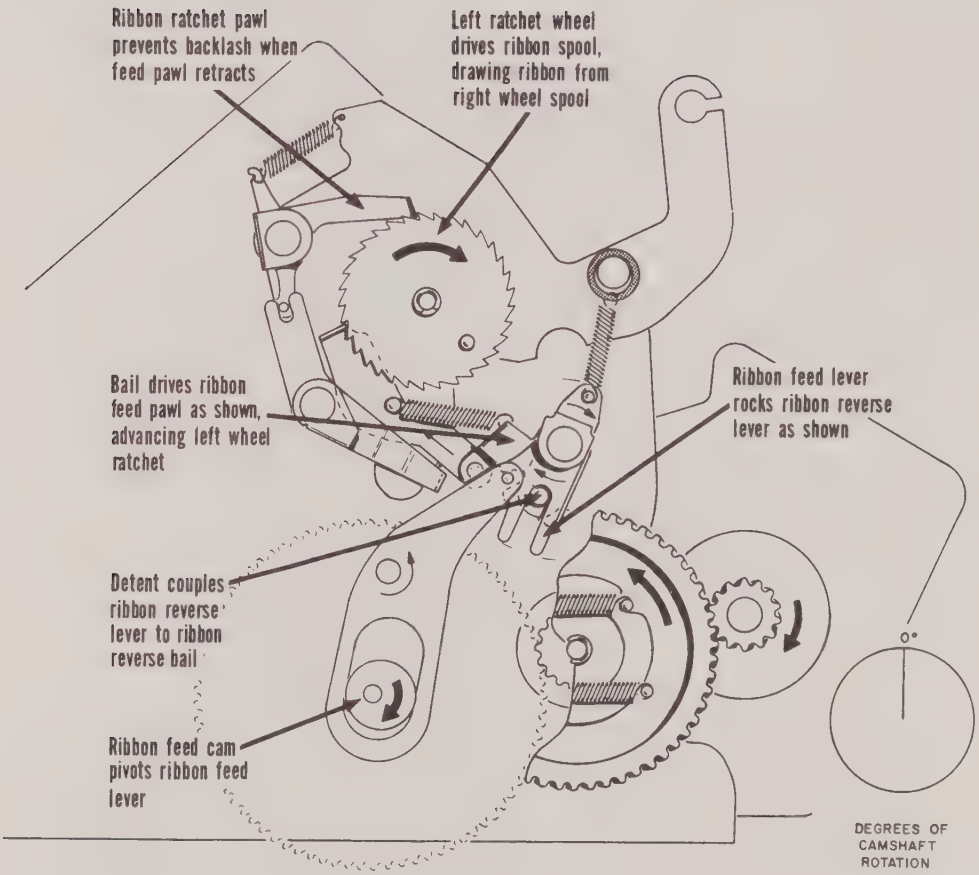

Ribbon ratchet pawl prevents backlash when feed pawl retracts
Left ratchet wheel drives ribbon spool, drawing ribbon from right wheel spool
Bail drives ribbon feed pawl as shown, advancing left wheel ratchet
Ribbon feed lever rocks ribbon reverse lever as shown
Detent couples ribbon reverse lever to ribbon reverse bail
Ribbon feed cam pivots ribbon feed lever
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-27.
RIBBON REVERSE

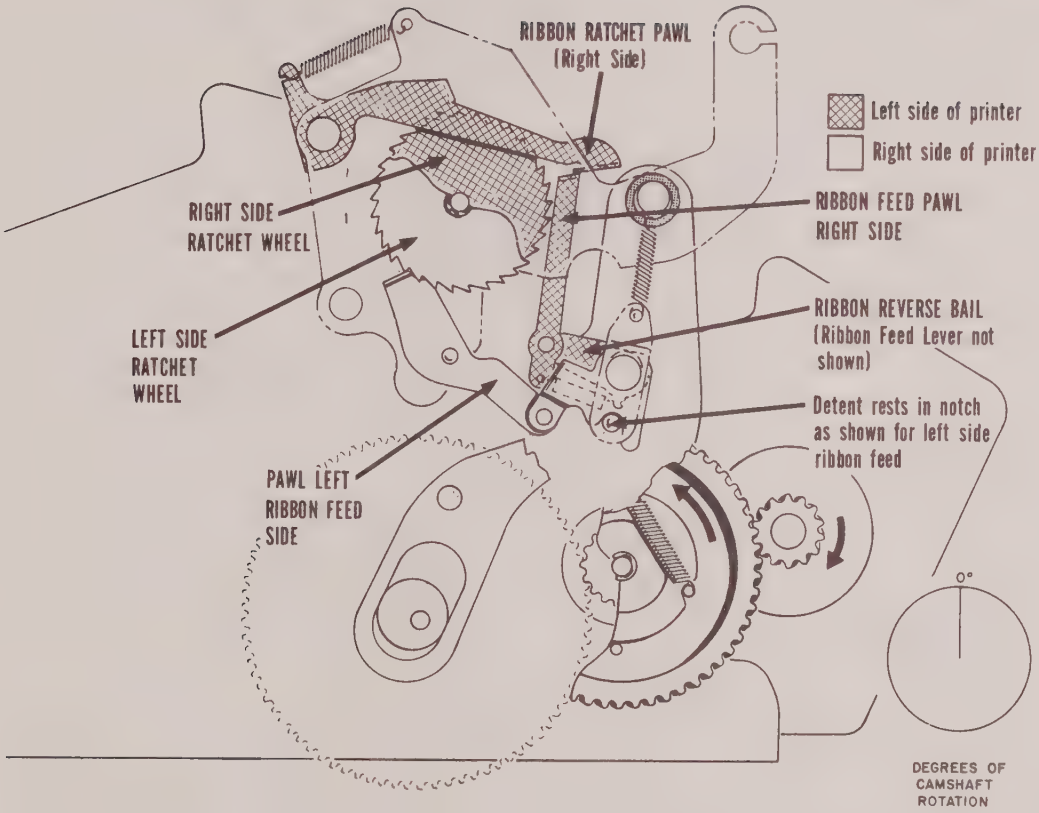


FIG. 3-28.
RIBBON REVERSE
(From Right Feed
to Left Feed)

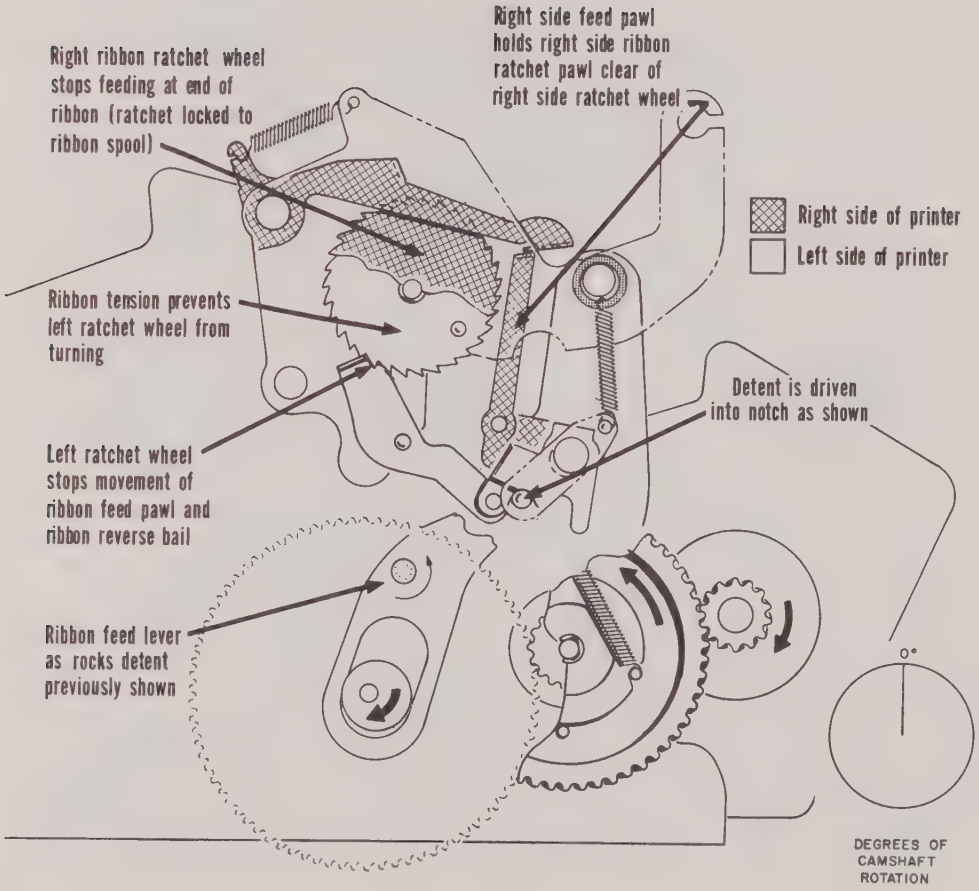

Right ribbon ratchet wheel stops feeding at end of ribbon (ratchet locked to ribbon spool)
Right side feed pawl holds right side ribbon ratchet pawl clear of right side ratchet wheel
Right side of printer
Left side of printer
Ribbon tension prevents left ratchet wheel from turning
Detent is driven into notch as shown
Left ratchet wheel stops movement of ribbon feed pawl and ribbon reverse bail
Ribbon feed lever as rocks detent previously shown
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-29.
RIBBON FEED
(Left to Right Feed)

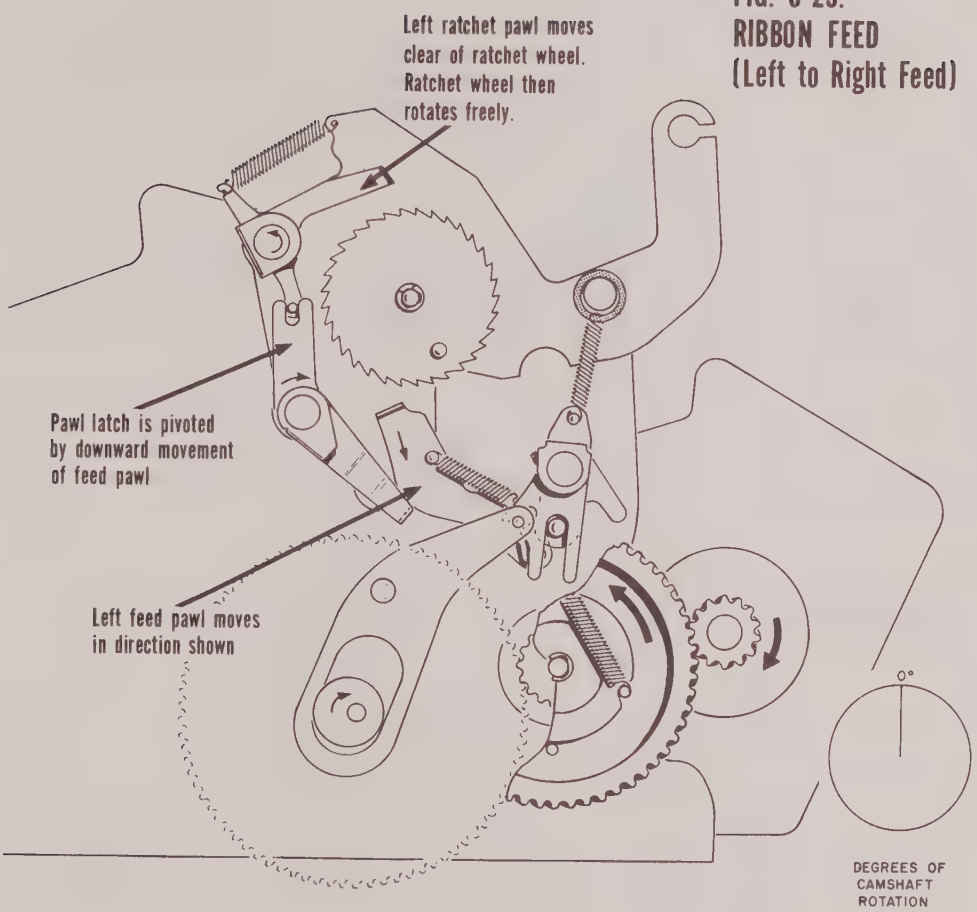
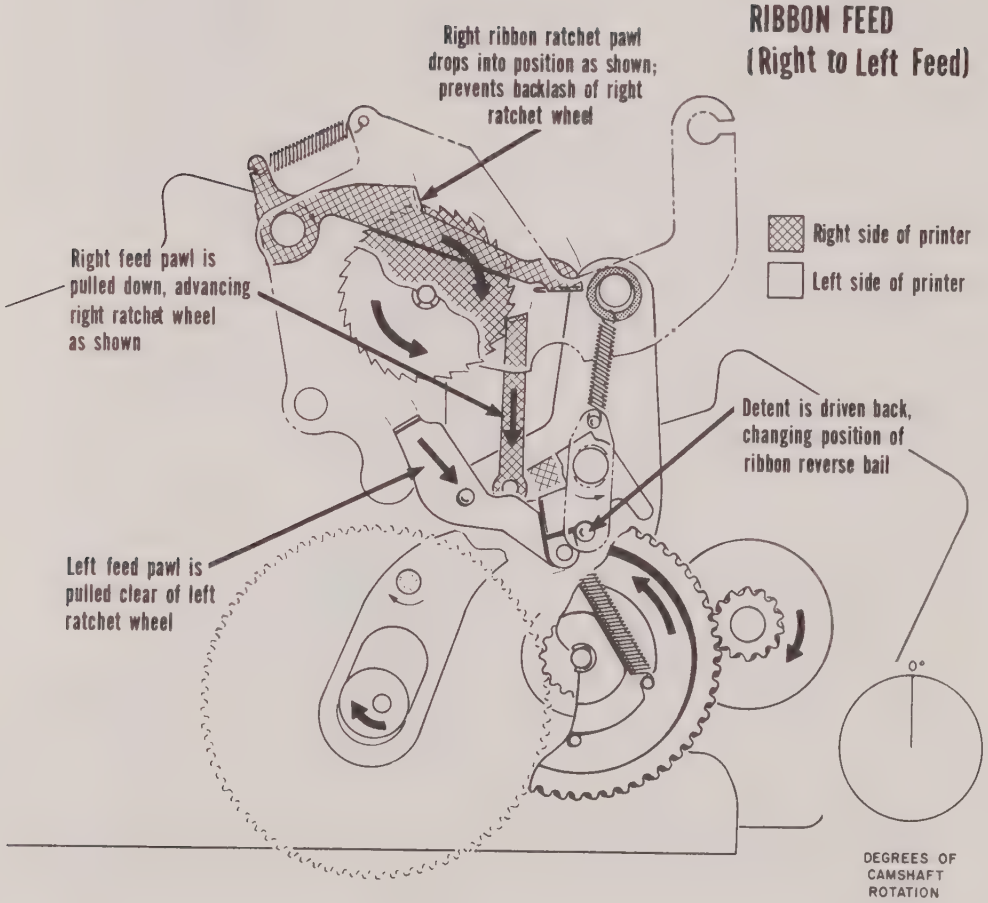

Left ratchet pawl moves clear of ratchet wheel. Ratchet wheel then rotates freely.
Pawl latch is pivoted by downward movement of feed pawl
Left feed pawl moves in direction shown
0°
DEGREES OF CAMSHAFT ROTATION

FIG. 3-30.
RIBBON FEED
(Right to Left Feed)


Right ribbon ratchet pawl drops into position as shown; prevents backlash of right ratchet wheel
Right feed pawl is pulled down, advancing right ratchet wheel as shown
Left feed pawl is pulled clear of left ratchet wheel
Detent is driven back, changing position of ribbon reverse bail
Right side of printer
Left side of printer
0°
DEGREES OF CAMSHAFT ROTATION

SECTION 4
SERVICING

4.1 PREPARING PRINTER FOR SERVICING

4.1.1 Removing Printer from Case

To remove the portable case, pull out the catch on each side of the case, near the bottom, then slide the case back and up.

To remove the printer from its rack adapter or bench cabinet, give a quarter turn counterclockwise to the two screws below the paper compartment; then slide the printer forward.

4.1.2 Removing Printer Mechanism

For most of the mechanical servicing procedures described in this section, you will need to remove the printer mechanism, as shown in Figure 4-1.

4.1.3 Manual Operation of Printer Mechanism

When servicing the printer, it is often necessary to cycle the mechanism by hand, as follows:

1) After removing the mechanism (Figure 4-1), turn the left side of the printer toward you. Between the side plate and the pawl magnet assembly you will find the mechanical trigger shown in Figure 4-2.

2) Press upward the lever indicated in Figure 4-2. The clutch will then engage.

3) Drive the mechanism through one cycle by rotating the large nylon gear in the gear train counterclockwise (the gear engages with the drive motor pinion).

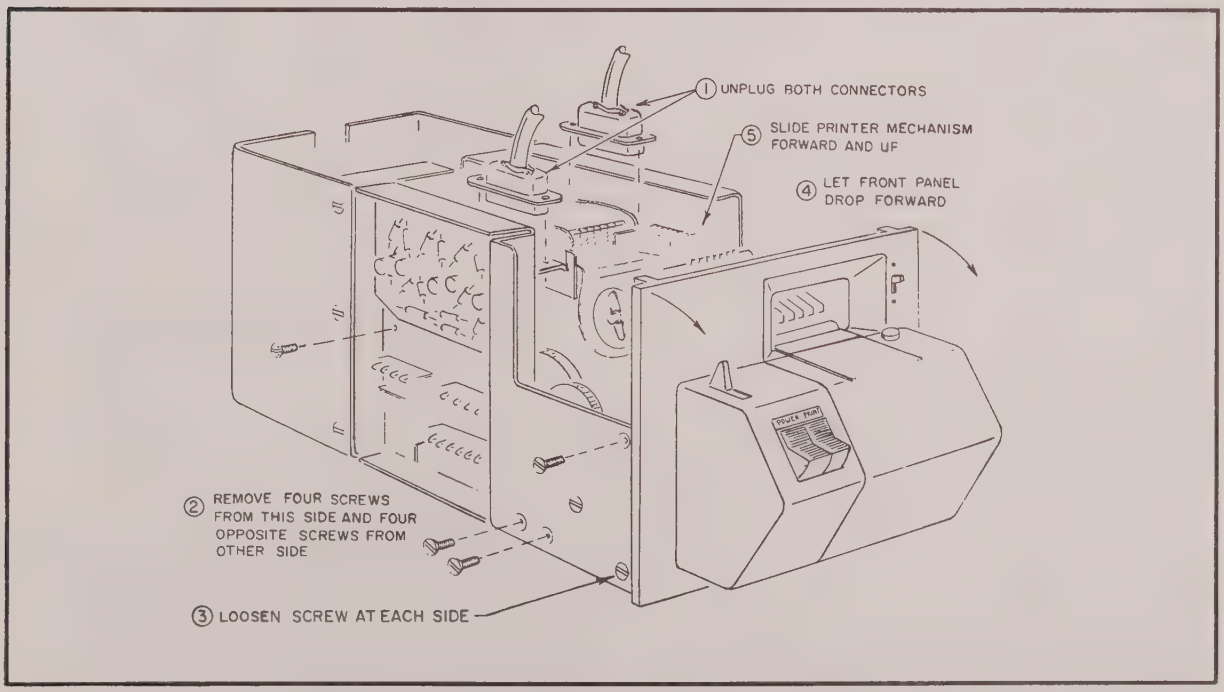

① UNPLUG BOTH CONNECTORS
⑤ SLIDE PRINTER MECHANISM FORWARD AND UP
④ LET FRONT PANEL DROP FORWARD
② REMOVE FOUR SCREWS FROM THIS SIDE AND FOUR OPPOSITE SCREWS FROM OTHER SIDE
③ LOOSEN SCREW AT EACH SIDE

FIG. 4-1. Removing Printer Mechanism.

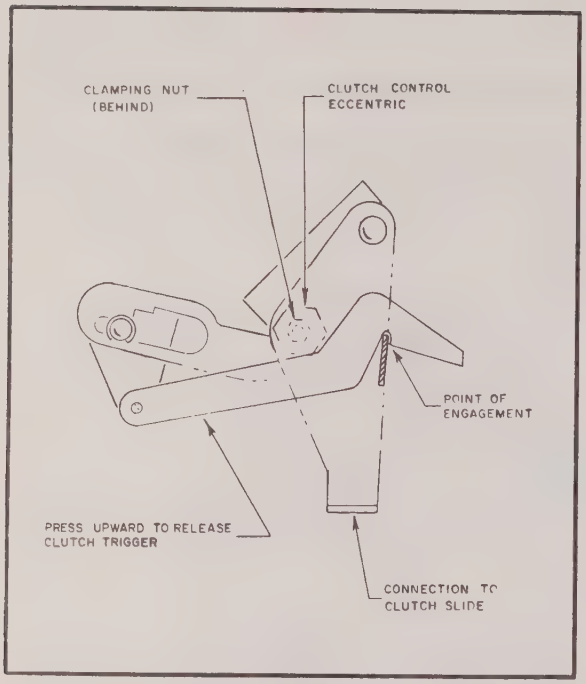


FIG. 4-2. Adjusting Clutch Control Eccentric.

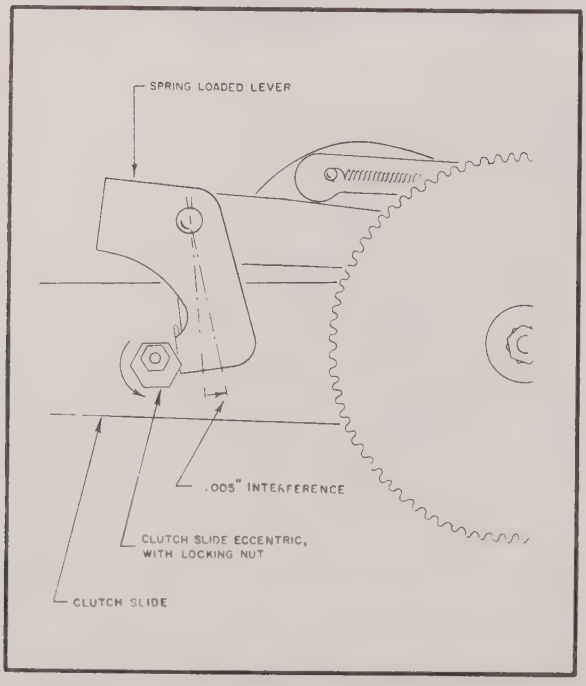


FIG. 4-3. Adjusting Clutch Slide Eccentric.

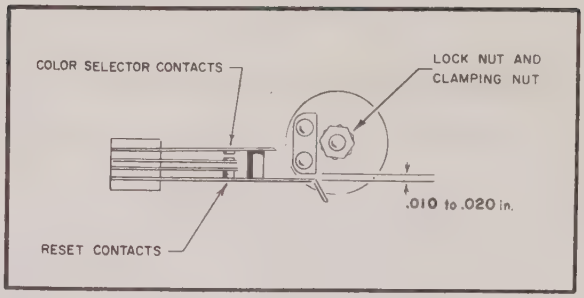


FIG. 4-4. Correct adjustment of cam switch at normal rest position.

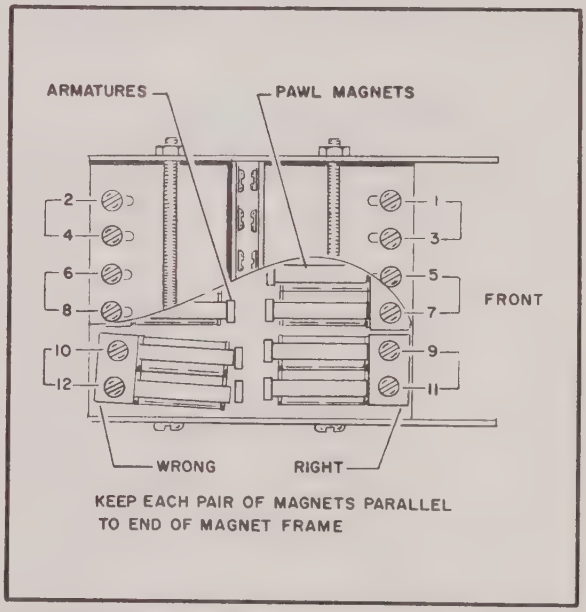


FIG. 4-5. Internal arrangement of pawl magnet assembly as seen from above printer (for side view see Figure 3-11).

4.2 TROUBLESHOOTING

To gain a thorough understanding of the circuit logic, first study Section 3 and the Timing Diagram on page 5-4a. Then refer to the following tables which summarize possible troubles, their causes and solutions.

Table 4-1. Troubleshooting

PROBLEM	POSSIBLE CAUSE AND/OR SOLUTION
PRINT Command does NOT start cycle	1) Make sure print switch is in PRINT position. 2) Check if print command is reaching control trigger circuit. Watch color selector (K102). Even with print switch at STANDBY, K102 should be energized when print command line is negative; de-energized when positive. 3) Measure voltage at pin 7 of V101. It should be identical to print command line input. 4) Continuity-check print command line up to pin 5 of connector C. 5) Check cam switch adjustment (see Table 4-2). 6) Measure signal at collector of Q107. The collector should be at ground when print command line is negative; at -28 volts when positive. 7) Replace V101. 8) Check Q107 as follows: a) Connect pin 8 of V101 to +16 volts (collector should be negative). b) Remove V101. Collector should be between -10 volts and ground. If not, replace Q107. 9) Check clutch actuator driver, Q108, as follows: a) Using a scope, determine what occurs at the collector of Q108 during a print command. b) If the collector does not move to ground for at least 20 ms, adjust or clean contacts on K103C (Fig. 3-9). c) Check Q108 or T102 (may be defective). 10) See whether K103 is being actuated as follows: a) Ground collector of Q108 through 100 mA meter. (The clutch should operate mechanism continuously with a current of 80 mA.) b) If current does not flow, the winding of K102 is open, or there is a break in the wiring to K103. c) If current is flowing and K103 is energized, the clutch actuating mechanism is out of adjustment.
Single Print Command produces more than one cycle of operation. (Cause may be electrical or mechanical)	1) Place mechanism in an unwanted cycle and set PRINT switch to STANDBY. If printer stops at end of cycle, problem is electrical. Proceed as follows: a) Set POWER switch to OFF. b) Cycle mechanism by hand while watching operating sequence of type alignment bar and reset contacts (lower set) on cam switch. c) Close contacts fully and separate from cam one-half turn of plastic gear before type alignment bar touches clutch actuator. d) Adjust cam switch timing (see Table 4-2). 2) Repeat step 1. If K103 is energized and switching to STANDBY does not stop operation, either the type alignment bar does not press armature of K103 far enough to break latching contacts, or Q108 has excessive collector leakage. Proceed as follows:

. . . continued

Table 4-1. Troubleshooting (continued)

PROBLEM	POSSIBLE CAUSE AND/OR SOLUTION
	a) Pull out connector P102 (at left front of mechanism) to stop the motor. b) Energize K103 with a single print command. c) Operate mechanism by hand until type alignment bar presses armature of K103. (The motion should be enough to press armature against frame of magnet, releasing it; the magnet should then remain de-energized.) NOTE If mechanical action is correct, remove connector P101 (on pawl magnet assembly) and press PRINT switch to STANDBY to prevent actuation of Q108. Place milliammeter between collector of Q108 and -28 volt supply to determine leakage. At high-line voltage (135V rms) leakage must not exceed 50 microamps at 25°C. If greater, replace Q108. 3) Repeat step 1. If clutch actuator is de-energized and cycle continues: a) Turn off the printer and check adjustment of clutch control eccentric (see Table 4-2). b) If this appears correct, increase spring tension on clutch trigger by pulling spring sideways (spring runs from trigger to actuator frame). c) If operation improves, shorten spring slightly. d) Make sure that mechanism works well at low line voltage (95 volts rms).
One or more columns do NOT print	1) Make sure modules are not upside down or loose in their sockets. 2) Replace suspected module with one from a correct column (to rule out possibility of defective module). 3) Check for changing input data after print command. Data should not change. 4) Remove input connector from module in faulty column and operate printer (column should print a random number). If a blank impression is produced, the pawl magnet for that column may be out of position. Adjust magnet as described in Table 4-2.
All columns produce blank impression	1) Measure all supply voltages to rule out failure of power supply. 2) Check reset line (should be at -14 volts when mechanism is in rest position.) Reset failure may be due to wrong adjustment of cam switch. (Figure 4-4 shows correct adjustment.) 3) Make sure there is no change in input data after print command. 4) Inspect pawl magnet assembly (mechanism may be jammed so that stop pawls do not reset). Operate mechanism by hand, making sure that pawl reset link (right side, internal) advances and suddenly retracts near end of cycle, actuating pawl reset bail. The overtravel spring should not operate. 5) Check if pawl reset link is in place over end of cam actuating lever. There should be a small coil spring running down and back from lever to side plate.

Table 4-2. Mechanical Adjustments

PART	ADJUSTMENT
Clutch Control Eccentric	When a single print command produces more than one cycle of operation, the clutch control eccentric may be out of adjustment (as indicated in Table 4-1). a) Manually operate printer through one cycle until clutch slide has moved to its most rearward position (Fig. 4-2). b) Loosen clamping nut. c) Turn eccentric so that clutch trigger engages with a minimum of overtravel of clutch slide. (Movement of slide from its extreme position to its normal cocked position should be less than 0.030 inches.)
Clutch Slide Eccentric	Adjust clutch slide eccentric after adjustment of clutch control eccentric (above). Adjust for 0.005 inch interference between eccentric and spring-loaded lever that bears on it (Fig. 4-3).
Cam Switch	Adjust cam switch timing by moving the cam on its shaft (Fig. 4-4). a) Loosen lock nut and clamping nut. b) Rotate cam so that (in normal rest position) it clears follower leaf by 0.010 to 0.020 inches. Adjustment is correct when reset contacts do not open with normal overtravel of shaft, but open before excursion control bar begins to move as machine is cycled.
Pawl Magnet Position	The pawl magnet assembly (located on top of the type bars) comprises either eight or twelve pawl magnets arranged in pairs (see Figures 4-5 and 3-11). Each pair is held to the magnet frame by two slotted screws. Proceed as follows if troubleshooting procedure (Table 4-1) indicates that a pawl magnet is out of position (see Fig. 4-5): a) Loosen pair of screws holding suspected magnet. (Do not remove screws.) b) Place power to OFF and mechanism in rest position. Carefully move magnet until it touches the armature. c) Center both magnets of the pair on their armatures. (Figure 4-5 shows right and wrong adjustments.) Clearance between magnet cores and armatures should be zero in reset (rest) position, but cores should exert no significant force on the armatures. d) Tighten clamping screws. e) Make sure machine is printing correctly, then lock screws with Glyptol or similar substance.

Table 4-3. Lubrication Procedure

CAUTION

Carefully clean bearings and surfaces before applying lubricants. Since oil dissolves grease, make sure that oil does not run onto greased surfaces. Oil first, wipe off all excess, then apply grease.

Oiling of mechanical parts with enclosed bearing surfaces (levers, rollers on shafts, sliding members in close-fitting guides):	1) Use a good grade of light machine oil. 2) Lubricate mechanism every 500,000 impressions, or every six months.
Greasing of mechanical parts (cam surfaces, loose-fitting sliding members, gear teeth, needle bearing of main cam shaft):	1) Apply a high-grade grease, such as Lubriplate #2. 2) Grease mechanism every 500,000 impressions, or every six months.

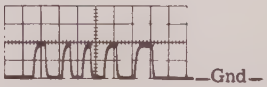
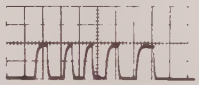
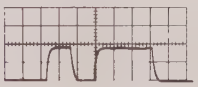
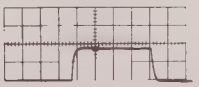
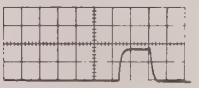
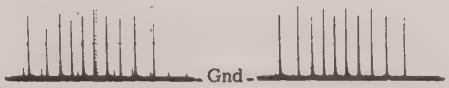
NOTE

Bearings of drive motor are packed and sealed at the factory. They require no maintenance.

Table 4-4. Typical Waveforms

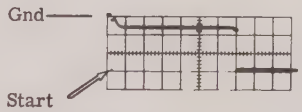
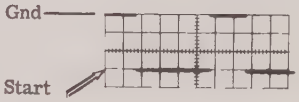
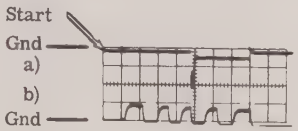
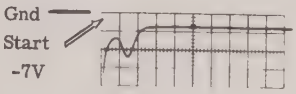
NOTE

Oscilloscope used: Tektronix Model 581 with type CA Preamplifier. All signals dc coupled.

TEST POINT	SIGNAL	VERT. SCALE	TIME SCALE	WAVEFORM
CODE GENERATOR OUTPUTS P202, pin 1	POSITIVE SYNC ON RESET LINE P202, pin 7 Line 1 (1st bit): binary pulse output of Position Transducer.	5V/Div.	10ms/Div.	1-2-2-4 Code  Gnd Weight 1 1-2-4-2 (1-2-4-8) Code  Weight 1
P202, pin 2	Line 2 (2nd bit)	5V/Div.	10ms/Div.	 Gnd Weight 2  Weight 2
P202, pin 4	Line 3 (3rd bit)	5V/Div.	10ms/Div.	 Gnd Weight 2  Weight 4
P202, pin 6	Line 4 (4th bit)	5V/Div.	10ms/Div.	 Gnd Weight 4  Weight 2
P202, pin 5	Clock pulse output of Position Transducer ------ NOTE ------ Both waveforms are identical. In the right-hand picture, the scale has been extinguished for clarity. ----------	5V/Div.	10ms/Div.	 Gnd

. . . continued

Table 4-4. Typical Waveforms (continued)

TEST POINT	SIGNAL	VERT. SCALE	TIME SCALE	WAVEFORM
CONTROL SIGNALS Q108, Collector	Clutch Actuation Voltage Sync: Positive, on Signal	10V/Div.	20ms/Div.	
Q107, Collector	Color Control, Red Sync: Positive, on Q108 Collector	10V/Div.	20ms/Div.	
Q107, Collector	Color Control, Black Sync: Positive, on Q108 Collector	10V/Div.	20ms/Div.	
a) P202, pin 9 b) P202, pin 1	a) Pawl magnet voltage, digit "5". b) Position Transducer Output Sync: Positive, on reset line (P202, pin 7)	a) 20V/Div. b) 10V/Div.	a) 10ms/Div. b) 10ms/Div.	
P202, pin 9	Pawl magnet voltage Sync: Negative on Signal	20V/Div.	1ms/Div.	
Q201, Base	Coincidence Output, Digit "7" Sync: Positive, on reset line (P202, pin 7)	2V/Div.	10ms/Div.	

SECTION 5
DIAGRAMS & PARTS LISTS

	Dwg. No.	Page
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NOTE: For additional parts ordering information see the Burroughs Parts Catalog.

PRINTER SHELL ASSEMBLY
PARTS LIST

Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
	855-419661	Printer Shell Assembly	Beckman	1
C101, 102, 103, 121, 125, 126	651-099620	Capacitor, F. Paper, 0.1μf, 400V, 20%	Cornell-Dubilier WMF4P1	6
C104 thru C113	637-804765	Capacitor, F. Mica, 220pf, 500V, 5%	Sangamo RR1322	10
C114	631-005621	Capacitor, F. Elect., 3000μf, 15V	Sprague TVL1170	1
C115	631-401953	Capacitor, F. Elect., 3000μf, 30V	Beckman	1
C116	631-812751	Capacitor, F. Elect., Dual, 1000-2000μf	Mallory WP200. 2	1
C118, 119	633-808479	Capacitor, F. Cerm., 0.02μf, 150V	Centralab DDM-203	2
C120	637-804751	Capacitor, F. Mica, 75pf, 500V, 5%	Sangamo RR1475	1
C122, 124	633-804706	Capacitor, F. Cerm., 1000pf, 1000V	Centralab DD-102 (10%)	2
CR101 thru CR106, 117	755-416842	Diode	Beckman	7
CR107 thru 115	755-409096	Diode, Special	Beckman	9
CR116, 118, 119	755-402107	Diode, Special	Beckman	3
CR120 thru 123	755-404593	Diode, Special	Beckman	4
F101, 102	731-814854	Fuse, Elect., 1.0A, 125V	Littelfuse Type 313	2
J101	672-806814	Connector, Receptacle, 25 Female	Cannon DB-25S	1
J102	672-812863	Connector, Plug, 15 Female	Cannon DA-15S	1
P101	664-812450	Cordset, Elect., Power, 3 Cond., Blk, 6 feet	Beckman	1
P104	678-806896	Connector, Plug, Header, 11-pin	Amphenol 86-CP11	1
P105	678-099028	Connector, Plug, Header, 8-pin	Jones 8PB	1
Q101 thru Q106	755-800398	Transistor, Germ., PNP, 150mW	Sylvania 2N404	6
Q107, 108	755-406666	Transistor, Special	Beckman	2
R101, 105, 108, 112 thru 118, 120, 123, 125, 126, 128, 130, 133, 134, 139, 141	601-008089	*Resistor, 12K, 1/2W, 10%	*AB EB1231	20
R102, 103, 104, 106, 107, 109, 110, 111, 136, 151	601-008078	Resistor, 1.5K, 1/2W, 10%	AB EB1521	10
R119, 124, 127, 129, 131, 132, 140, 147	601-008094	Resistor, 33K, 1/2W, 10%	AB EB3335	8
R121	601-008059	Resistor, 2.2K, 1W, 10%	AB GB2221	1
R122	601-008866	Resistor, 2.2M, 1/2W, 10%	AB EB2251	1
R135	601-801559	Resistor, 47K, 1/2W, 10%	AB EB4731	1
R137	601-008087	Resistor, 8.2K, 1/2W, 10%	AB EB8225	1
R138	601-008065	Resistor, 100Ω, 1/2W, 10%	AB EB1011	1
R142	601-002211	Resistor, 100K, 1/2W, 10%	AB EB1041	1

*All resistors are fixed composition; Manufacturer - Allen Bradley.

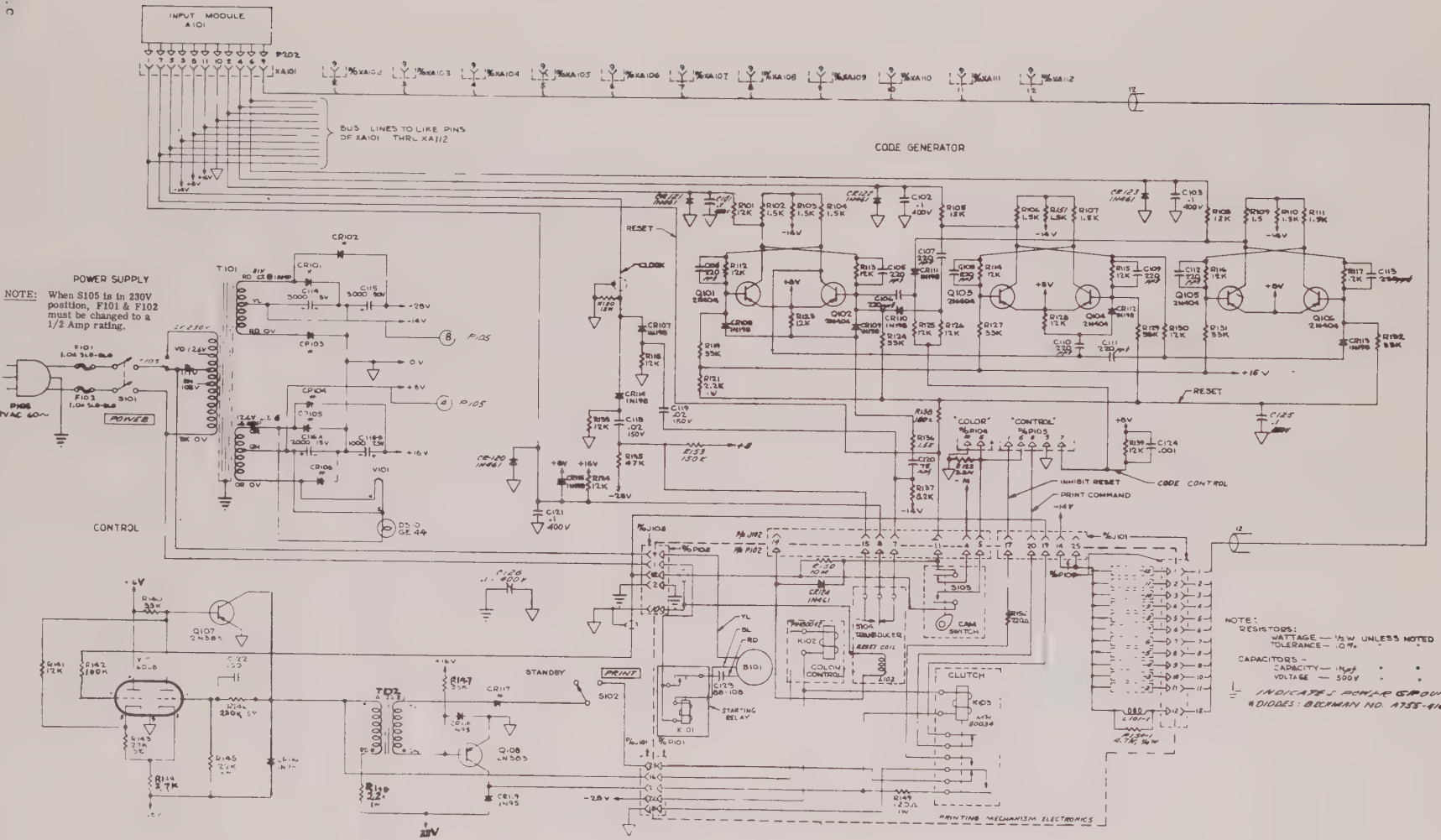
. . . continued

PARTS LIST

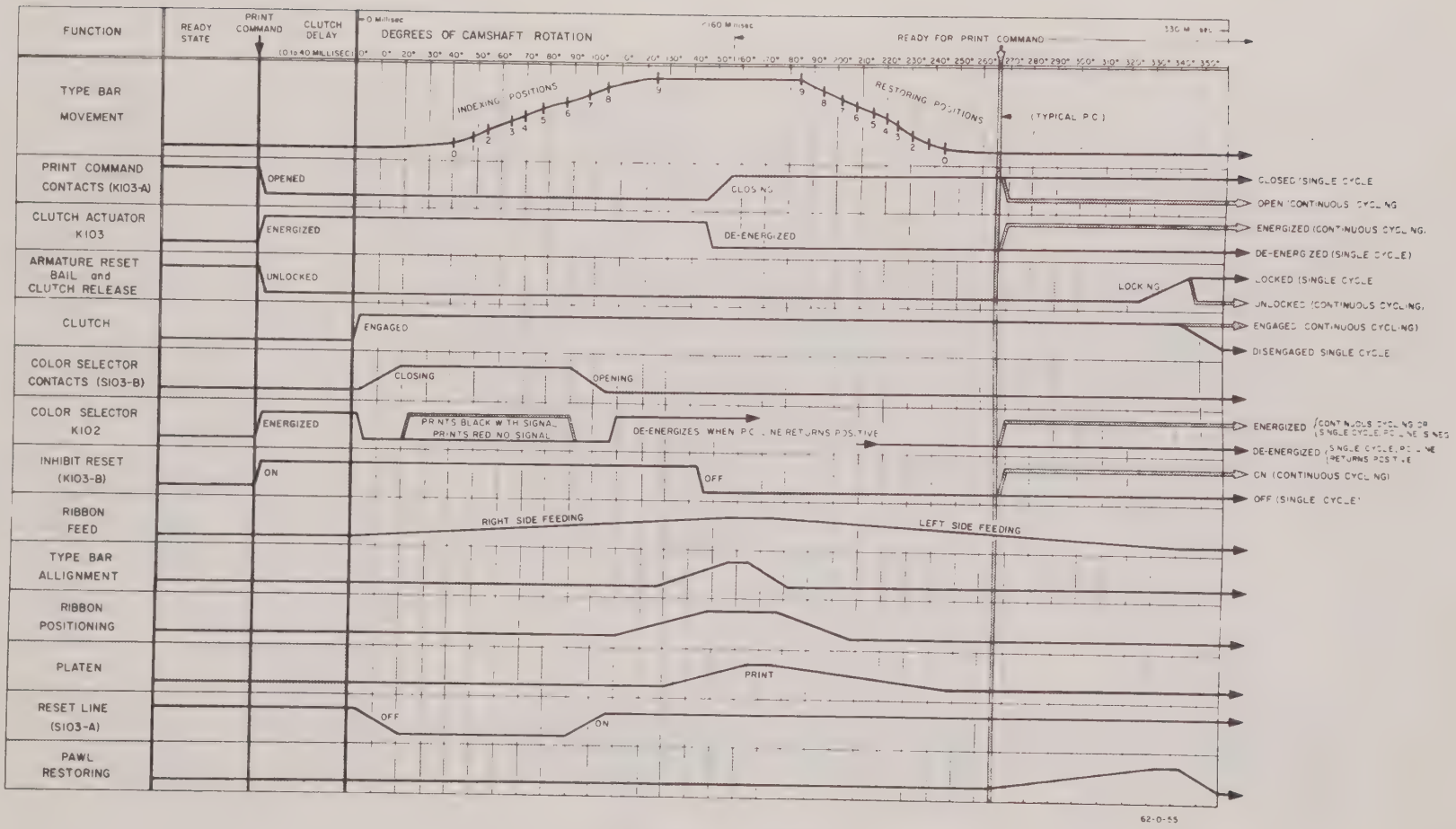
Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
R143	601-015058	Resistor, 27K, 1/2W, 5%	Allen Bradley EB2735	1
R144	601-015045	Resistor, 2.7K, 1/2W, 5%	Allen Bradley EB2725	1
R145	601-000565	Resistor, 22K, 1/2W, 5%	Allen Bradley EB2235	1
R146	601-015083	Resistor, 220K, 1/2W, 5%	Allen Bradley EB2245	1
R148	601-008059	Resistor, 2.2K, 1W, 10%	Allen Bradley GB2221	1
R153	601-008774	Resistor, 150K, 1/2W, 10%	Allen Bradley EB1541	1
R154	601-815239	Resistor, 4.7K, 1/4W, 10%	Allen Bradley CB4721	1
S105	716-829988	Switch, Slide	Carling Elec. S-112-RD	1
T101	792-418625	Transformer, Power	Beckman	1
T102	792-812868	Transformer, Interstage	Triad A-122Z	1
V101	751-800237	Electron Tube, Duotriode, Type 6DJ8	Amperex 6DJ8	1
XDS101	824-815706	Socket, Lamp, w/22 in. leads	Leecraft 2-06-Modif	1
XF101, 102	735-007268	Fuseholder, 15A at 250V Breakdown	Bussman HKP	2
XV101	860-002064	Socket, Tube, 9-pin, w/shield base (p/o 40-404641)	Cinch Mfg. 44B12621	1
	697-812867	Connector, Hood, (for DA-15 Connectors)	Cannon DA-J/S	1
	697-807056	Connector, Hood, (straight for DB25 Connector)	Cannon DA-J/S	1
	697-812865	Screw Lock Assembly, Male	Cannon DA20419	4
	860-016990	Socket, Tube, 11-pin, Saddle Mtg.	Amphenol 77-M1P-11	12
	664-404647	Module Cable	Beckman	1
	664-404649	Power Cable	Beckman	1
	855-404623	Magnet Coil Assembly	Beckman	1
	877-404624	Bobbin, Magnet Coil	Beckman	1
	795-404622	Magnet Coil	Beckman	1
	279-812854	Ribbon, black/red, med. 7/16"	Burroughs	1

8-DIGIT & 12-DIGIT PRINTER
PARTS LIST

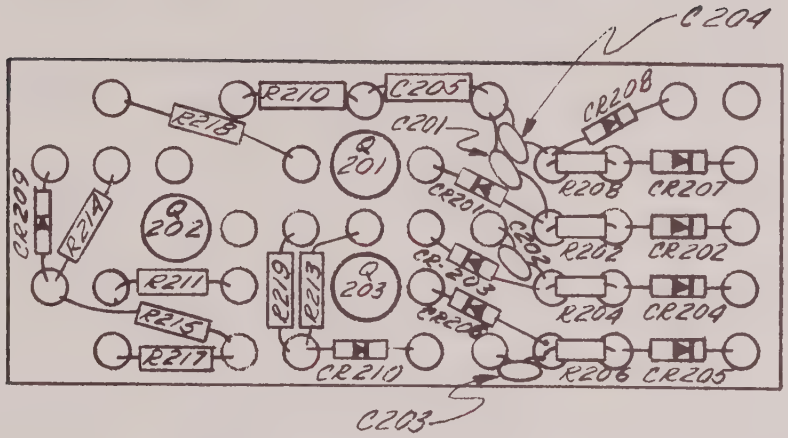
Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
	050-419090	Eight-Digit Printer	Beckman	
	050-419091	Twelve-Digit Printer	Beckman	
C123	xxx-xxxxxx	Capacitor, Variable, 88-108	Part of 20-404688	1
CR124	755-404593	Diode, Silicon, Special	Beckman	1
DS101	825-099143	Lamp, Incandescent, Min., Bayonet Base	G.E. #44	1
K101	xxx-xxxxxx	Relay, Motor Starting	Part of 20-404688	1
K102	718-405661	Relay, Form B, 21V Pull-In	Beckman	1
K103	718-405660	Relay, Form I and Form B, 18V Pull-In	Beckman	1
L101	795-404622	Magnet Coil	Beckman	1
P101	672-806813	Connector, Receptacle, 25 Male Contacts	Cannon DB-25P	1
P102	672-815017	Connector, Receptacle, 15 Male Contacts	Cannon DA-15P	1
R149	601-029801	Resistor, F.Comp., 120Ω, 1W, 10%	Allen Bradley GB1211	1
R150	601-[illegible]11180	Resistor, F.Comp., 10M, 1/2W, 10%	Allen Bradley EB1061	1
R152	601-[illegible]08069	Resistor, F.Comp., 220Ω, 1/2W, 10%	Allen Bradley EB2211	1
S101, 102	716-404452	Switch, Push, 2 ea. DPDT Sections	Beckman	1
S103	716-404717	Switch, Cam, Form A and Form B	Beckman	1
S104	716-857264	Relay	Clare RP8425G1	1
	662-404732	P102 Cable	Beckman	1
	855-404623	Magnet Coil Assembly	Beckman	12
	855-406359	Magnet Assembly, 12 Digit	Beckman	1

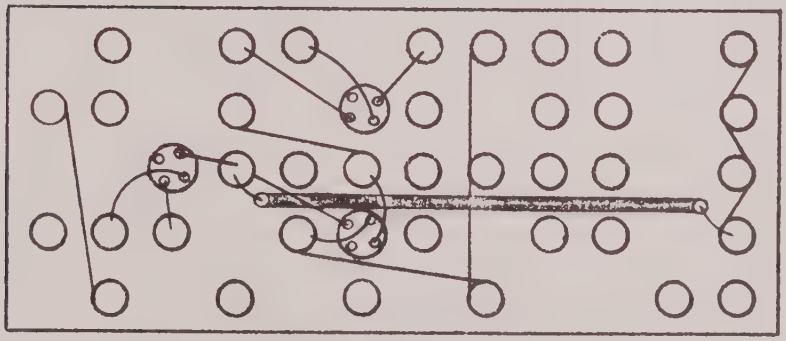


MODEL 1453 MASTER SCHEMATIC DIAGRAM



TIMING DIAGRAM



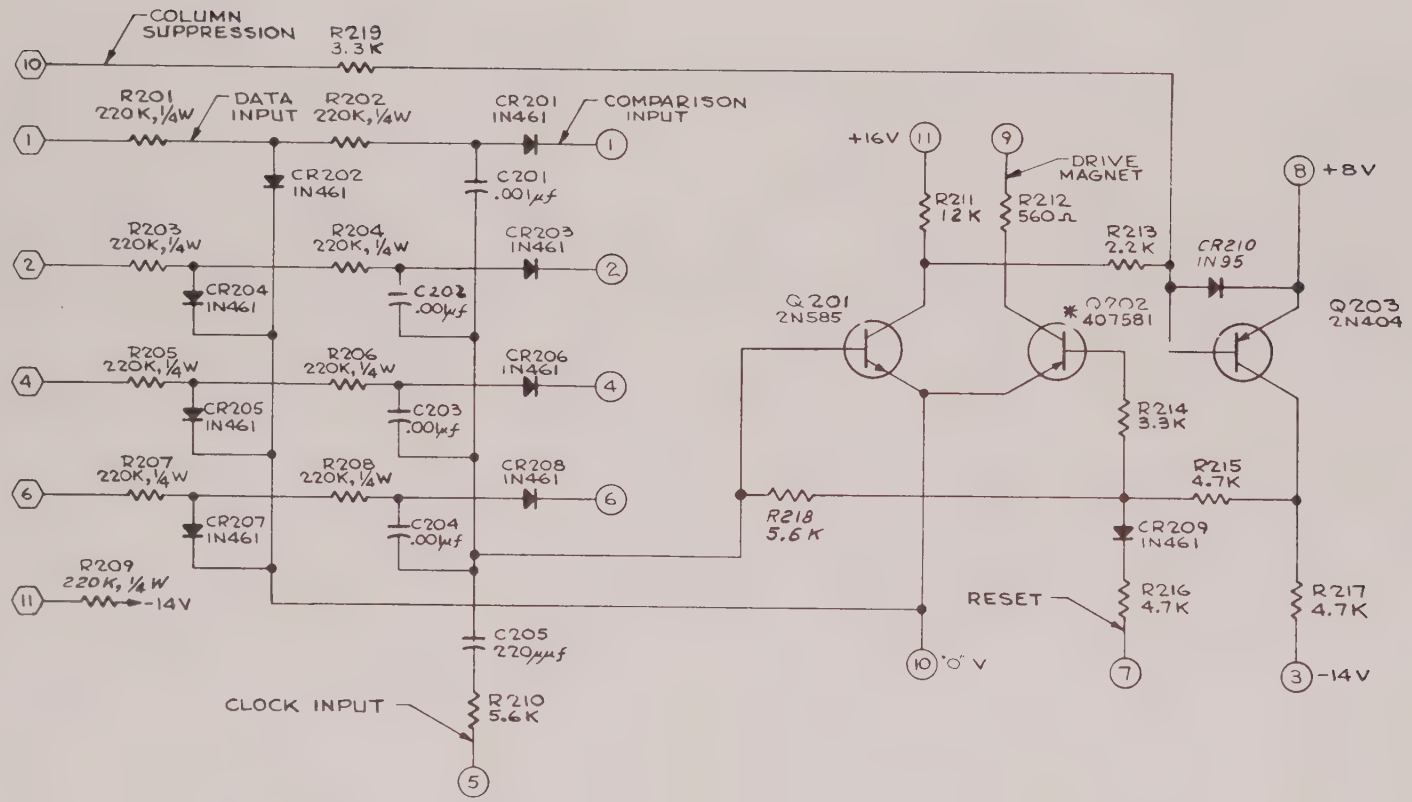


FOUR-LINE INPUT MODULE ASSEMBLY
COMPONENT LAYOUT

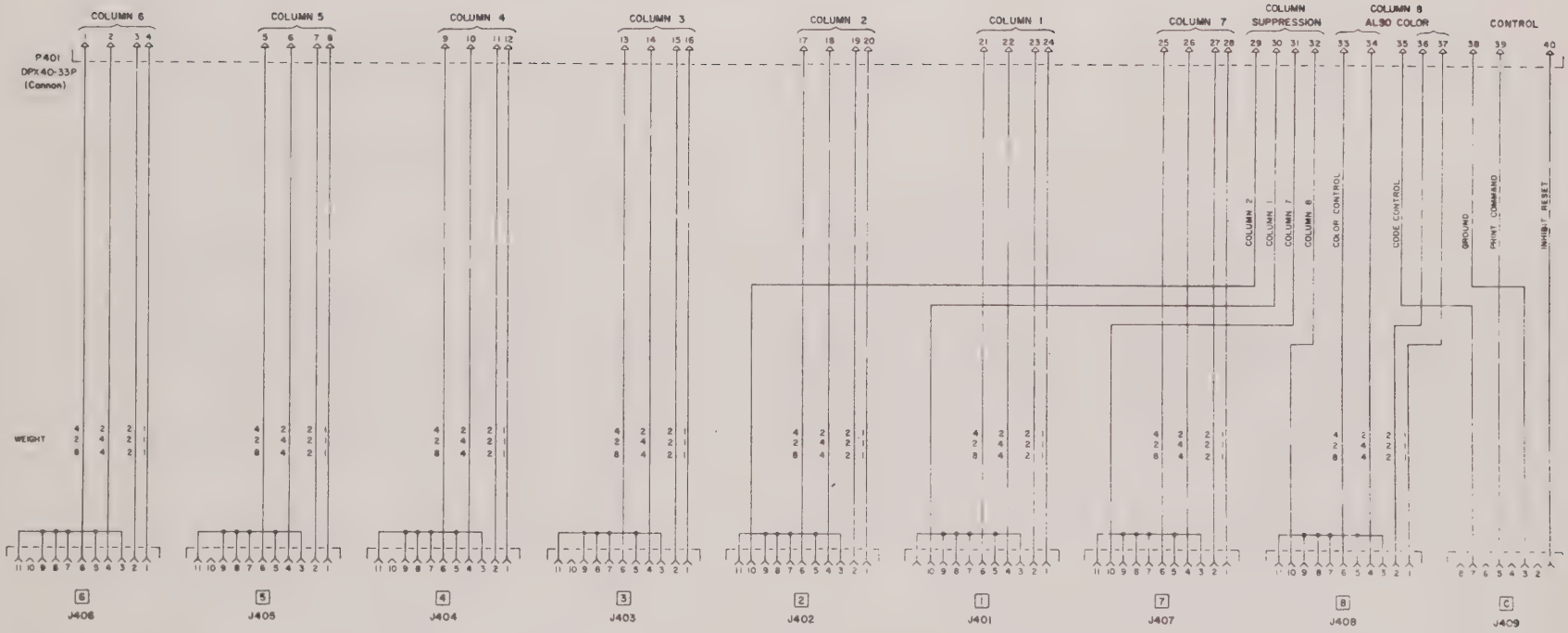
FOUR-LINE INPUT MODULE
PARTS LIST

Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
	887-404459	Four-Line Module Final Ass'y	Beckman	
	855-404474	Four-Line Module P.C. Board	Beckman	1
C201, 202, 203, 204	633-804706	Capacitor, Ceramic Disc., 0.001μf, 1KV	Centralab DD-102	4
C205	637-804765	Capacitor, F.Mica, 220pf, 500V, 5%	Sangamo RR1322	1
CR201 thru CR209	755-404593	Diode, Silicon	Beckman	9
CR210	755-402107	Diode, Selected	Beckman	1
P201, 202	678-806896	Plug, 11-pin, (Header)	Amphenol 86-CP11	2
Q201	755-800415	Transistor	G.E. 2N585	1
Q202	755-407581	Transistor	Beckman	1
Q203	755-800398	Transistor	Sylvania 2N404	1
R201 thru R209	601-812742	Resistor, F.C., 220K, 1/4W, 10%	Allen Bradley CB2241	9
R210, 218	601-008085	Resistor, F.C., 5.6K, 1/2W, 10%	Allen Bradley EB5621	2
R211	601-008089	Resistor, F.C., 12K, 1/2W, 10%	Allen Bradley EB1231	1
R212	601-008073	Resistor, F.C., 560Ω, 1/2W, 10%	Allen Bradley EB5611	1
R213	601-008080	Resistor, F.C., 2.2K, 1/2W, 10%	Allen Bradley EB2221	1
R214, 219	601-010684	Resistor, F.C., 3.3K, 1/2W, 10%	Allen Bradley EB3321	2
R215 thru R217	601-008084	Resistor, F.C., 4.7K, 1/2W, 10%	Allen Bradley EB4721	3

NOTE:
1) RESISTORS:
WATTAGE — 1/2W UNLESS NOTED
TOLERANCE — 10% " "
2) ⬡ — INDICATES PINS OF P201
3) ◯ — INDICATES PINS OF P202
4) * BECKMAN PART NO.



FOUR-LINE INPUT MODULE SCHEMATIC DIAGRAM



NOTE

J401 thru J408 Amphenol 78-SIIT

J409 Amphenol 78-S8

82-D-56

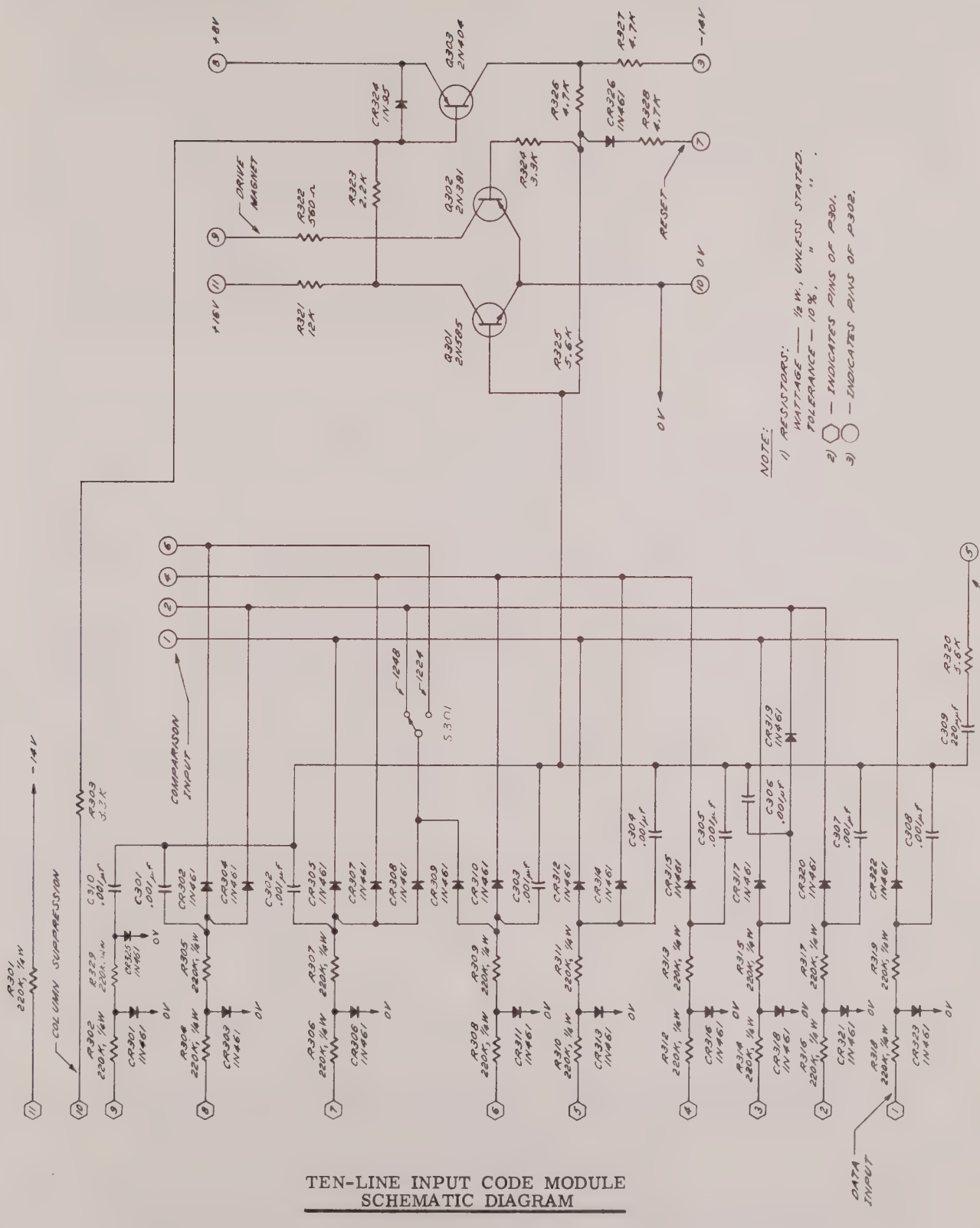
FOUR-LINE INPUT CABLE SCHEMATIC DIAGRAM

TEN-LINE INPUT MODULE ASSEMBLY "B"
COMPONENT LAYOUT

TEN-LINE INPUT MODULE ASSEMBLY "A"
COMPONENT LAYOUT

TEN-LINE INPUT MODULE
PARTS LIST

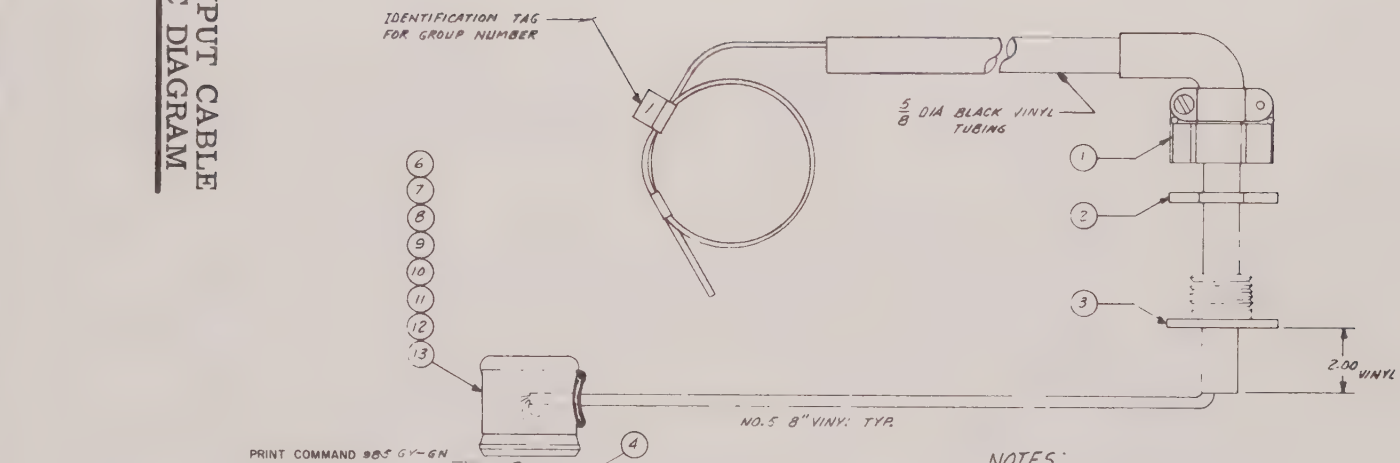
Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
	887-404453	Ten-Line Module Final Ass'y	Beckman	
	855-404476	Ten-Line Module Board "A"	Beckman	
	855-404478	Ten-Line Module Board "B"	Beckman	
C301 thru C308, C310	633-804706	Capacitor, Ceramic Disc., 0.001μf, 1KV	Centralab DD-102	9
C309	637-804765	Capacitor, F.Mica, 220pf, 500V, 5%	Sangamo RR1322	1
CR301 thru CR323, 325, 326	755-404593	Diode, Silicon	Beckman	25
CR324	755-402107	Diode, Selected	Beckman	1
P301, 302	678-806896	Plug, 11-pin, (Header)	Amphenol 86-CP11	2
Q301	755-800415	Transistor	G.E. 2N585	1
Q302	755-099432	Transistor, Type 2N381	Tung-Sol Elec.	1
Q303	755-800398	Transistor	Sylvania 2N404	1
R301, 302, R304 thru 319, R329	601-812742	Resistor, F.C., 220K, 1/4W, 10%	Allen Bradley CB2241	19
R303, 324	601-010684	Resistor, F.C., 3.3K, 1/2W, 10%	Allen Bradley EB3321	2
R320, 325	601-008085	Resistor, F.C., 5.6K, 1/2W, 10%	Allen Bradley EB5621	2
R321	601-008089	Resistor, F.C., 12K, 1/2W, 10%	Allen Bradley EB1231	1
R322	601-008073	Resistor, F.C., 560Ω, 1/2W, 10%	Allen Bradley EB5611	1
R323	601-008080	Resistor, F.C., 2.2K, 1/2W, 10%	Allen Bradley EB2221	1
R326, 327, 328	601-008084	Resistor, F.C., 4.7K, 1/2W, 10%	Allen Bradley EB4721	3
S301	716-812753	Switch, Slide, DPDT	Oak Mfg. Co., Type 78	1



TEN-LINE INPUT CODE MODULE
SCHEMATIC DIAGRAM

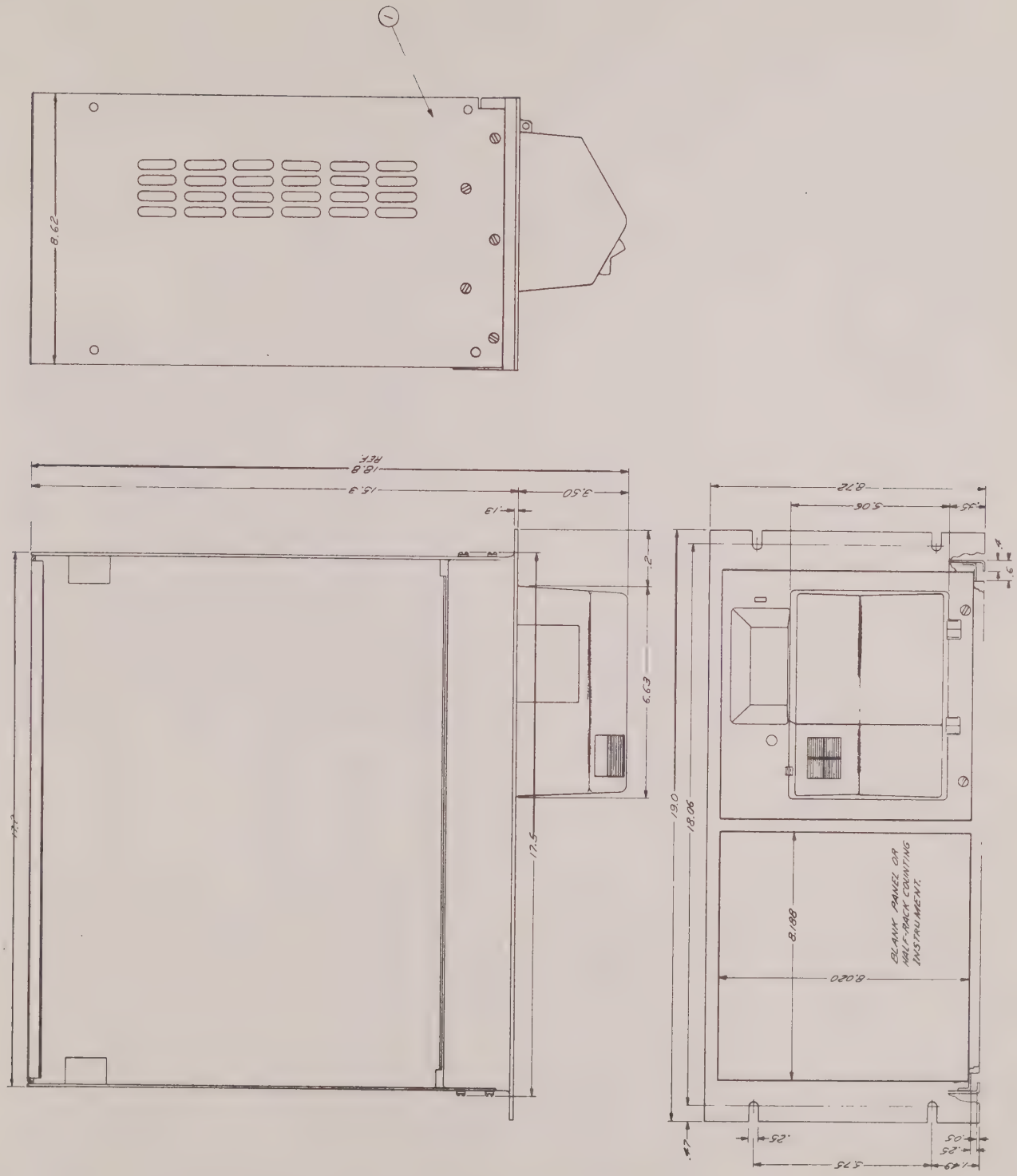
TEN-LINE INPUT CABLE SCHEMATIC DIAGRAM

	WIRE NO.	PIN NO.	COLOR
GROUP 1	910		BN - BK
	911		BN - BN
	912		BN - RD
	913		BN - OR
	914		BN - YL
	915		BN - GN
	916		BN - BL
	917		BN - VO
	918		BN - GY
	919		BN - WH
GROUP 2	920		RD - BK
	921		RD - BN
	922		RD - RD
	923		RD - OR
	924		RD - YL
	925		RD - GN
	926		RD - BL
	927		RD - VO
	928		RD - GY
	929		RD - WH
GROUP 3	930		OR - BK
	931		OR - BN
	932		OR - RD
	933		OR - OR
	934		OR - YL
	935		OR - GN
	936		OR - BL
	937		OR - VO
	938		OR - GY
	939		OR - WH
GROUP 4	940		YL - BK
	941		YL - BN
	942		YL - RD
	943		YL - OR
	944		YL - YL
	945		YL - GN
	946		YL - BL
	947		YL - VO
	948		YL - GY
	949		YL - WH
GROUP 5	950		GN - BK
	951		GN - BN
	952		GN - RD
	953		GN - OR
	954		GN - YL
	955		GN - GN
	956		GN - BL
	957		GN - VO
	958		GN - GY
	959		GN - WH
GROUP 6	960		BL - BK
	961		BL - BN
	962		BL - RD
	963		BL - OR
	964		BL - YL
	965		BL - GN
	966		BL - BL
	967		BL - VO
	968		BL - GY
	969		BL - WH
GROUP 7	970		VO - BK
	971		VO - BN
	972		VO - RD
	973		VO - OR
	974		VO - YL
	975		VO - GN
	976		VO - BL
	977		VO - VO
	978		VO - GY
	979		VO - WH
GROUP C	981		GY - BN
	983		GY - OR
	985		GY - GN
	986		GY - BL
	987		GY - VO

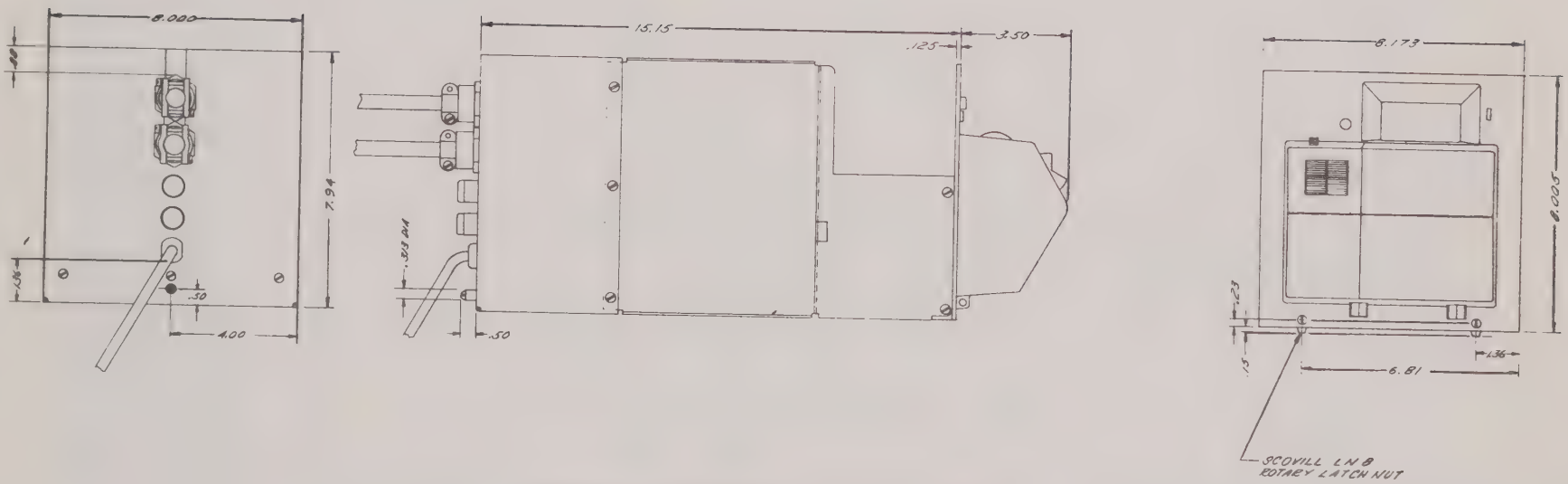


NOTES:
1) WIRE LENGTHS TO BE 12'0".
2) VINYL LENGTH TO BE 10'0".

ITEM	PART NO.	DESCRIPTION	QTY.
13	T697-404585	HOOD SILKSCREEN C	1
12	T697-404579	7	1
11	T697-404578	6	1
10	T697-404577	5	1
9	T697-404576	4	1
8	T697-404575	3	1
7	T697-404574	2	1
6	T697-404573	1	1
5	860-041948	11 PIN SOCKET	7
4	860-023566	8 PIN SOCKET	1
3	A699-404566	CANNON AN3064 - 0	1
2	699 801709	CANNON AN3066 -0	1
1	697-806383	CANNON AN3057 -10A	1



MODEL 1453 OUTLINE DRAWING
(In Half-Rack Mount)



MODEL 1453 INSTALLATION DRAWING

MODEL 507 STORAGE UNIT

The Model 507 Storage Unit permits the use of fan-folded paper tape instead of roll tape.

When fitted with the Model 507 Storage Unit, the printer can store up to 280 feet of 2-1/4 inch fan-folded paper tape. The tape is fed from and accumulated in convenient pull-out trays.

To insert the paper tape, follow these steps:

1) Remove upper tray. (Press sides, then pull.)

2) Lay tape in lower tray.

3) Bend end of paper up toward you. Fold it sharply across to make a straight leading edge.

4) Feed end into paper guide below platen (rubber roller).

5) Move paper advance lever several times until paper appears in outlet, making sure that paper is between inked ribbon and platen.

6) Insert upper tray.

7) Press paper release button and pull out enough paper to feed into upper tray.

MODIFYING OLDER BECKMAN INSTRUMENTS

Beckman instruments in current production have readout connections that are correct for the Model 1453. Earlier instruments need a slight modification to suit the printer. The modification automatically suppresses any digit columns not being used. Refer to Table 1 to determine if a modification is needed. No modification is required if the instrument serial number is higher than that shown in the table. But if the number is the same as or lower than that shown in the table, add the necessary wires to the DIGITAL RECORDER connector on the instrument.

Table 1

Model 1453 Compatibility with Older Beckman Instruments

Model	Highest Serial No.	Pins to be grounded	Model	Highest Serial No.	Pins to be grounded
5210	299	29, 30, 31, 32	7270	200	32
5220	183	29, 30, 31, 32	7350	1430	30, 31, 32
5230	601	29, 30, 31, 32	7351	262	30, 31, 32
5310	140	30, 31, 32	7360	4224	31, 32
5311	120	30, 31, 32	7361	405	31, 32
5571	1314	31, 32	7370	2374	32
7050	462	30, 31, 32	7700	170	31, 32
7060	552	31, 32	8070	104	32
7070	125	32	8150	102	30, 31, 32
7150	1627	30, 31, 32	8151	111	30, 31, 32
7151	437	30, 31, 32	8160	104	31, 32
7152	105	30, 31, 32	8175	111	32
7160	1098	31, 32	8260	101	31, 32
7161	170	31, 32	8350	103	30, 31, 32
7170	435	32	8351	102	30, 31, 32
7175	200	32	8360	102	31, 32
7250	521	30, 31, 32	8370	123	32
7260	396	31, 32			

SERIES J

TEN KEY
ADDING MACHINE
Before J241308D

CARRIAGES

KEYBOARD

SIDE FRAMES

ACCUMULATION

POWER

BASE & CASE

Burroughs

FIELD ENGINEERING

PARTS CATALOG

Printed in U.S. America Revised 9-20-65

Form 2900

IMPORTANT

This parts catalog, Form 2900, contains parts ordering information on Series J machines constructed before J241308D.

Coverage for machines constructed after J1001F is contained in Series J Parts Catalog, Form 2905.

CAUTION: Verify machine number before using this parts catalog.

PLEASE NOTE

The Burroughs Ten-Key Adding Machine has been modified for use in the Model 1453. For example, the case is not needed because the Model 1453 provides a housing for the mechanism. Also, it is evident that the keyboard is not required.

A list of plates, with associated parts lists, which do not apply to the Model 1453 Printer are:

Plates:	7 thru 9
	20 thru 24
	27 thru 34

These plates have been deleted from the manual.

Burroughs - Series J Parts Catalog

(File After Cover Page)

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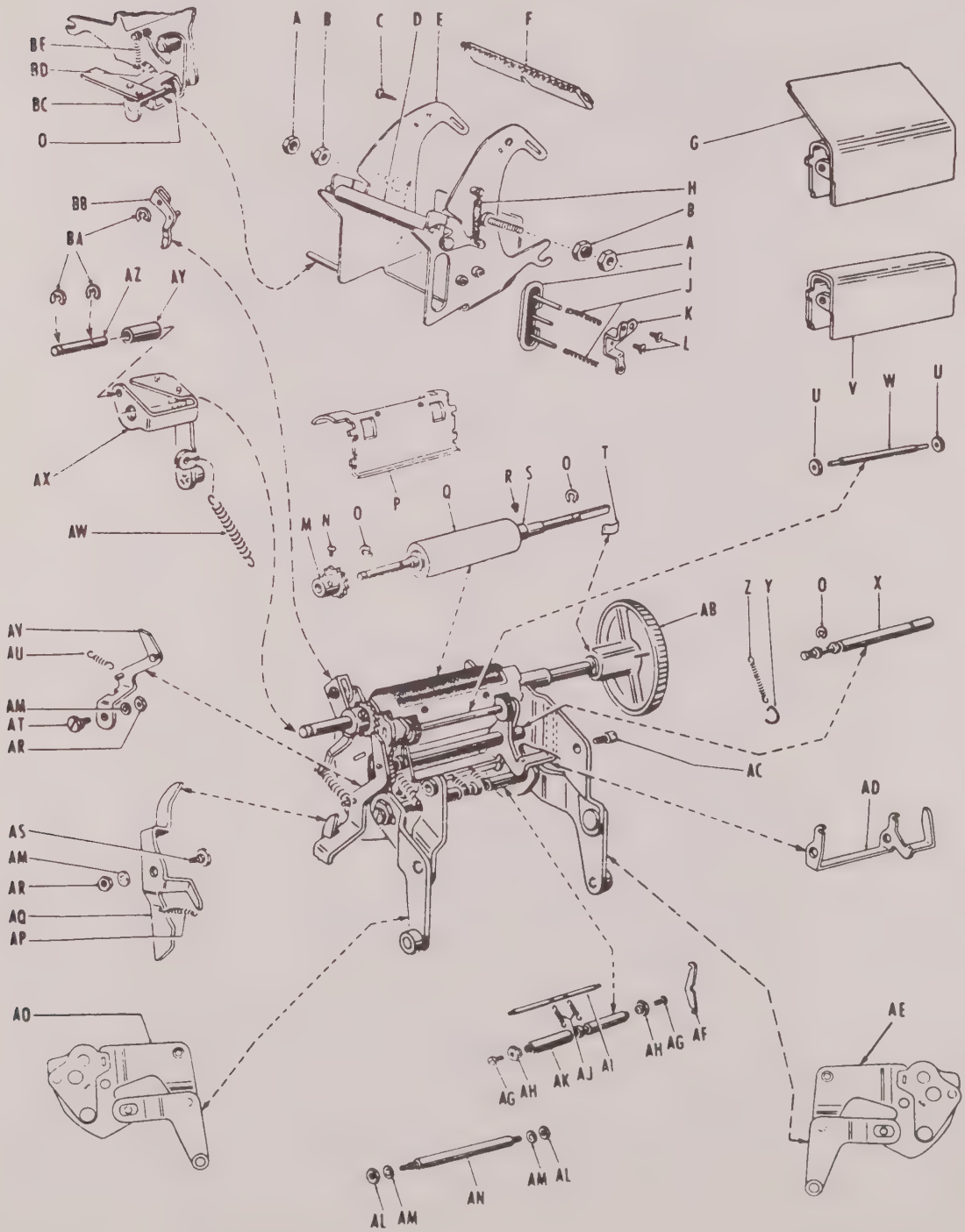
Printed in U.S. America Revised 9-20-65

For Form 2900

CARRIAGE ASSEMBLY AND ROLL PAPER HOLDER—BEFORE J56297D

(Plate 1)



PART NUMBERS ON NEXT PAGE

Carriages

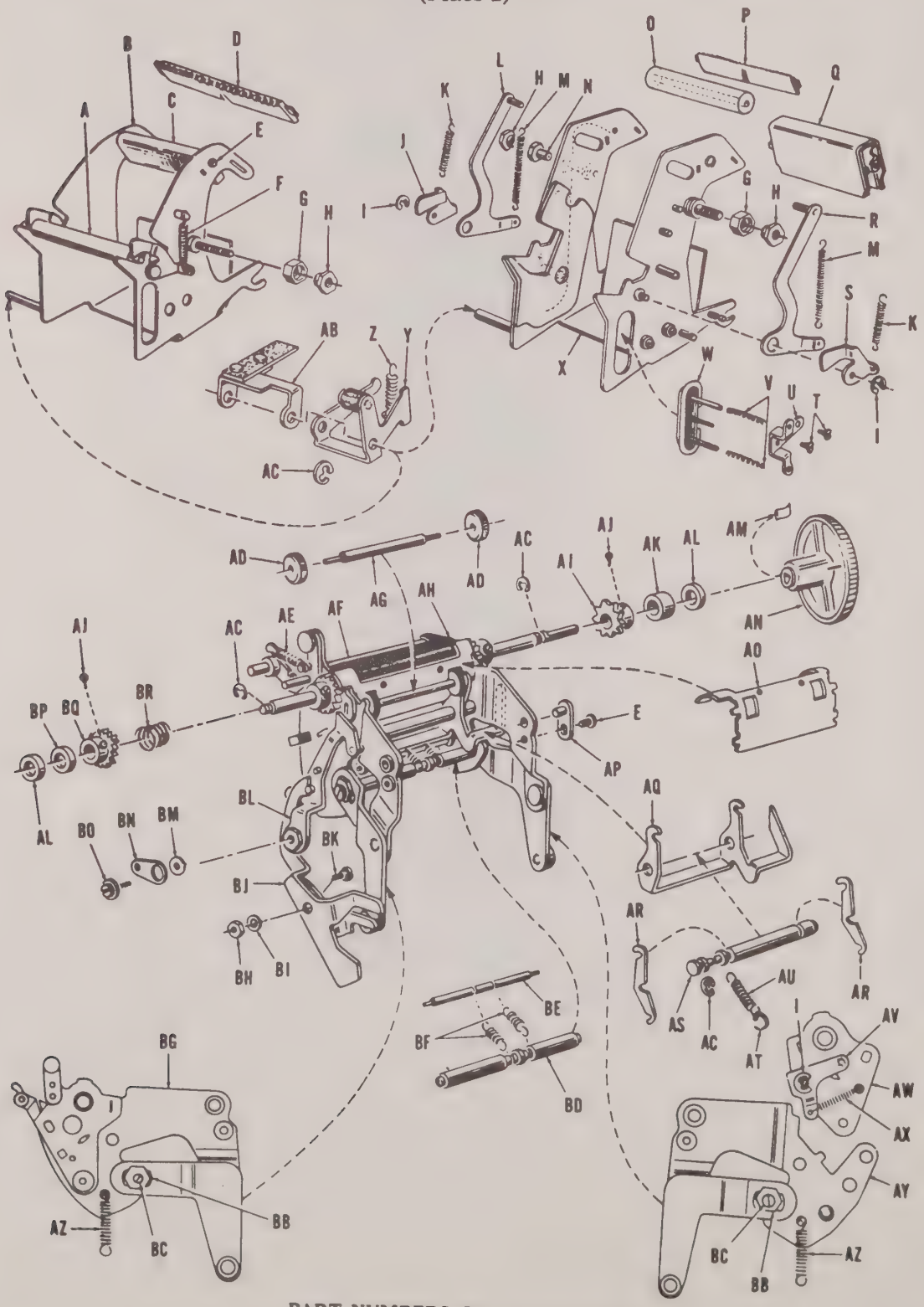
PART NUMBERS (Plate 1)

Note: 2JC117 complete assembled carriage

A X30-42 shown, lock nut
X30-5 flat nut, before J44254D
B X30-47 shown, adjusting nut
X30-5 flat nut, before J44254D
C JX218 screw, for mounting guide plate
D JC5-1 shown, after J44253D } roll paper shaft
JC5 before J44254D }
E 1JC15-2 roll paper holder frame
2JC15 complete assembled roll paper holder
F JC16-1 tear off blade
G 1JC26-1 writing table
H X80-24 spring
I JC29-2 pressure plate
J JX2-1 spring
K JC30 pressure plate guide bracket
L X60-132 screws
M JC18 feed ratchet wheel
N JX39 set screw
O 21 No. 26 clip
P JC7-1 paper guide pan
Q 1JC1 platen assembly
R 4463 screw
S 1-8344 set collar, includes R
T X81-14 flat retainer spring
U JC19 pressure roll
V 1JC26 guide plate
W JC6 pressure roll shaft
X JC4 pressure roll release bail shaft
Y 20 No. 73A spring anchor
Z X80-23 carriage restoring spring
AB 1JC20-6 platen twirler, use spring T
AC X60-29 carriage mounting and pivoting screw
AD 1028 4164 pressure roll release bail after J217188D
use 1028 4164 bail and 1028 4065 plug before J217189D
AE 1JC117-2 right carriage side frame
AF JC10 pressure roll lever
AG X60-252 locking screw
AH JX40 eccentric collar (2 req.)
AI JC21 grooved spring shaft
AJ 12083 springs for pressure roll assembly
AK JC3-1 tie shaft
AL 46½ hex. nut
AM X275-23 lockwasher
AN JC2-1 shown, after J25608D } eccentric tie shaft
JC2 before J25609D }
AO 1JC117-3 left carriage side frame
AP 79804 spring
AQ JD85 carriage restoring arm
AR 45¼ hex. nut
AS 94527 shoulder screw
AT X60-28 eccentric screw
AU 72861½ spring
AV 1JC13 spacing pawl
AW 53804 spring
AX 1JR11-1 left ribbon guide, see Plate 6, for other styles
AY 71334 No. 3 sleeve
AZ JR1 shaft
BA X133-105 clip
BB 1JC12 platen detent assembly
BC 1JC24 safety switch bail
BD 1JC23 safety switch bellcrank
BE 706811 spring

CARRIAGE ASSEMBLY AND ROLL PAPER HOLDER—AFTER J56296D

(Plate 2)



PART NUMBERS ON NEXT PAGE

Carriages

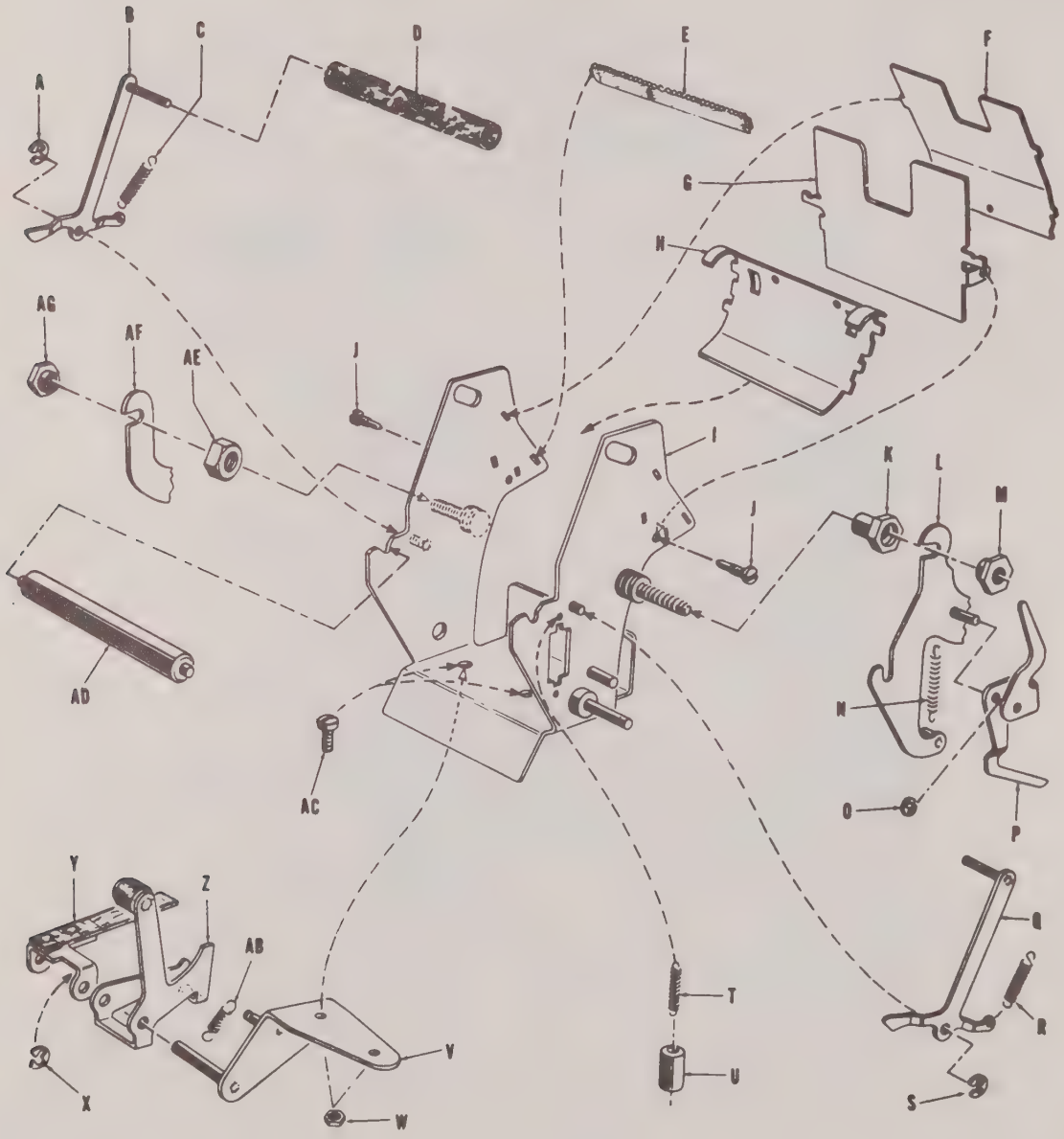
PART NUMBERS (Plate 2)

NOTE: **2JC15–1** complete Roll Paper Holder
2JC15–2 before J121885D complete Roll Paper Holder for J289 machines use (2) 72629 screws and X30-41, X30-42 nuts
2JC15–3 after J121884D
3JC117 complete Assembled Carriage
3JC117–1 complete Assembled Carriage for J289 machines

A **JC5–1** roll paper shaft
B **1JC15–8** before J121885D; 1029 0955 after J121884D; induction type mtr. mach. — paper holder frame
C **JC26–2** guide plate
D **JC16–1** tear-off blade
E **X60–36** screw
F **72826** spring
G **X30–42** lock nut
H **X30–47** adjusting nut
1 X133-105 clip
J **JC28–3** latch
K **X60–24** spring
L **1JC50–1** arm
M **86803** No. 3 spring
N **JX64** limit bushing
O **JC49** paper metering roll
P **JC16–2** tear-off blade
Q **1JC28** guide plate, use **44508** screws
R **1JC50** arm
S **JC28–2** latch
T **X60–132** screws
U **JC30** pressure plate guide bracket
V **JX2–1** compression springs
W **JC29–2** pressure plate
X Use **1JC15–9** paper holder frame and **JC29–2** pressure plate on machs. before J130800D
1JC15–9 paper holder frame on machs. after J130799D
Y **1JC23** safety switch bellcrank
Z **705811** spring
AB **1JC24** safety switch bail
AC **21 No. 26** clip
AD **JC19** pressure roll
AE **76806** spring
AF **JC2–1** eccentric tie shaft, use **46⅛** nuts
AG **JC6** pressure roll shaft
AH **1JC1–2** platen assembly
AI **JC18–2** platen star wheel
AJ **JX39** set screw
AK **JX13** spacer, for J289 only
AL **JX12** spacer, for J289 only
AM X81-7 flat retainer spring, included in AN
AN 1JC20-6 shown; 1JC20-7 Series J 400 — platen twirler
AO 1JC7-6 shown; 1JC7-7 Series J 400 — paper guide
AP 1JC35 carriage pivot
AQ 1028 4164 pressure roll release bail, after J217188D use 1028 4164 bail and 1028 4065 plug before J217189D
AR **JC10 pressure roll arm**
AS Use **JC4–5, JT5–5** shaft & **1205** 1⅜ screws on machs. between J56296D & J100944D; **JC4–5** used on machs. after J100943D; **JC4–1** used on machs. prior to removable platen — pressure roll release bail shaft
AT **20 No. 73A spring anchor, for J289** only
AU **X60–23** spring
AV **1JC12–1** ratchet
AW **1JC22–7** platen end plate
AX **7787** spring
AY **2JC117–11** right side frame
AZ **83806B** spring
BB **JX40** eccentric collar
BC **X60–252** screw
BD **JC3–1** tie shaft
BE **JC21** grooved spring shaft
BF **12083** spring
BG **2JC117–5** used from J56297D to J74502D; **2JC117–13** used after J74501D; **2JC117–12** for J289 machs. — left side frame
BH **45¼** hex. nut
BI **X275–23** lockwasher
BJ **2JD85–5** before J136967D (other than J289-90-91-92); **2JD85–6** between J136966D & J178632D (J289-90-91-92); **2JD85–10** after J178631D; **1JD85–4** before J178632D (Styles J289-90-91-92); **1JD85–7** after J178631D — cge. restoring arm
BK JD156 before J115953D; 405533 aft J115952D — shoulder screw
BL **1JC13–1** shown; **1JC13** for J289 machines — **spacing pawl, use 82803 spring**
BM **613½** washer
BN **JD129** adjusting link
BO **JC47** eccentric screw
BP **JX14** spacer, for J289 only
BQ **JC18–1** platen space ratchet
BR **JC53** spring

Carriages

ROLL PAPER HOLDER, SERIES J400 (PLATE 2-1)



PART NUMBERS ON NEXT PAGE

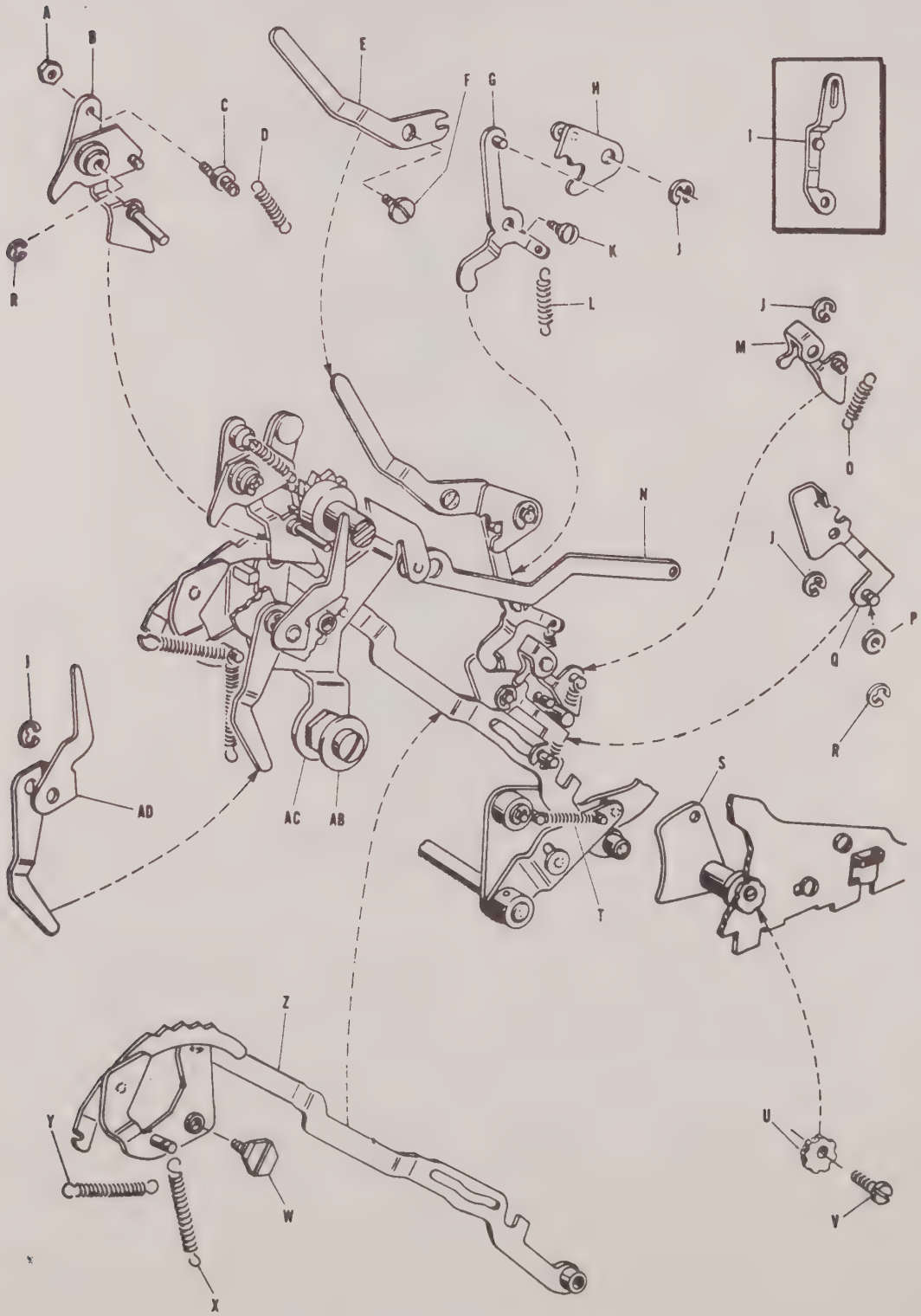
Carriages

PART NUMBERS (PLATE 2-1)

NOTE: 1029 7810 complete assembled paper holder

A X133-105 clip
B Use 1JC50-6 arm (right), 1JC50-7 arm (left) and (2) 74815 springs before J 209601D
1JC50-6 idler arm (right) after J209600D
C 99802 No. 2 spring
D JC49 paper metering roll
E JC16-2 tear-off blade
F 1029 9618 paper guide plate
G Use JC26-5 plate, 1029 5830 paper holder, 1JC50-6 arm (right) and 1JC50-7 arm (left) before J209601D
JC26-5 paper guide plate after J209600D
H 1JC7-7 paper guide pan
I Use 1029 5830 paper holder, JC26-5 plate, 1JC50-6, arm (right), 74815(2 reg.) and 1JC50-7 arm (left) before J209601D
1029 5830 roll paper holder after J209600D
J JX218 screw
K JX64 lock nut
L 1JR110 15 left side frame, ribbon assembly
M X30-47 adjusting nut
N 7283A Style 10 spring
O 21 No. 32 clip
P JR22 restoring arm, use 283A spring & 20 No. 108 spring anchor
Q Use 1JC50-7 arm (left), 1JC50-6 arm (right) and (2) 74815 springs before J209601D
1JC50-7 idler arm (left) after J209600D
R 10082 1/2 spring
S X133-105 clip
T 60807 spring
U JC29-4 pressure roll
V 1JM51 bracket, before J209601D
W 46 1/8 nut, before J209601D
X 21 No. 26 clip
Y 1JC24 safety switch bail
Z 1JC23-1 safety switch bellcrank
AB 702806 spring
AC 79510 screw, before J209601D
AD JC5-1 paper shaft
AE X30-42 lock nut
AF 1JR110-14 right side frame, ribbon assembly
AG X30-47 adjusting nut

PLATEN SPACING, 5/6" (Plate 3)



PART NUMBERS ON NEXT PAGE

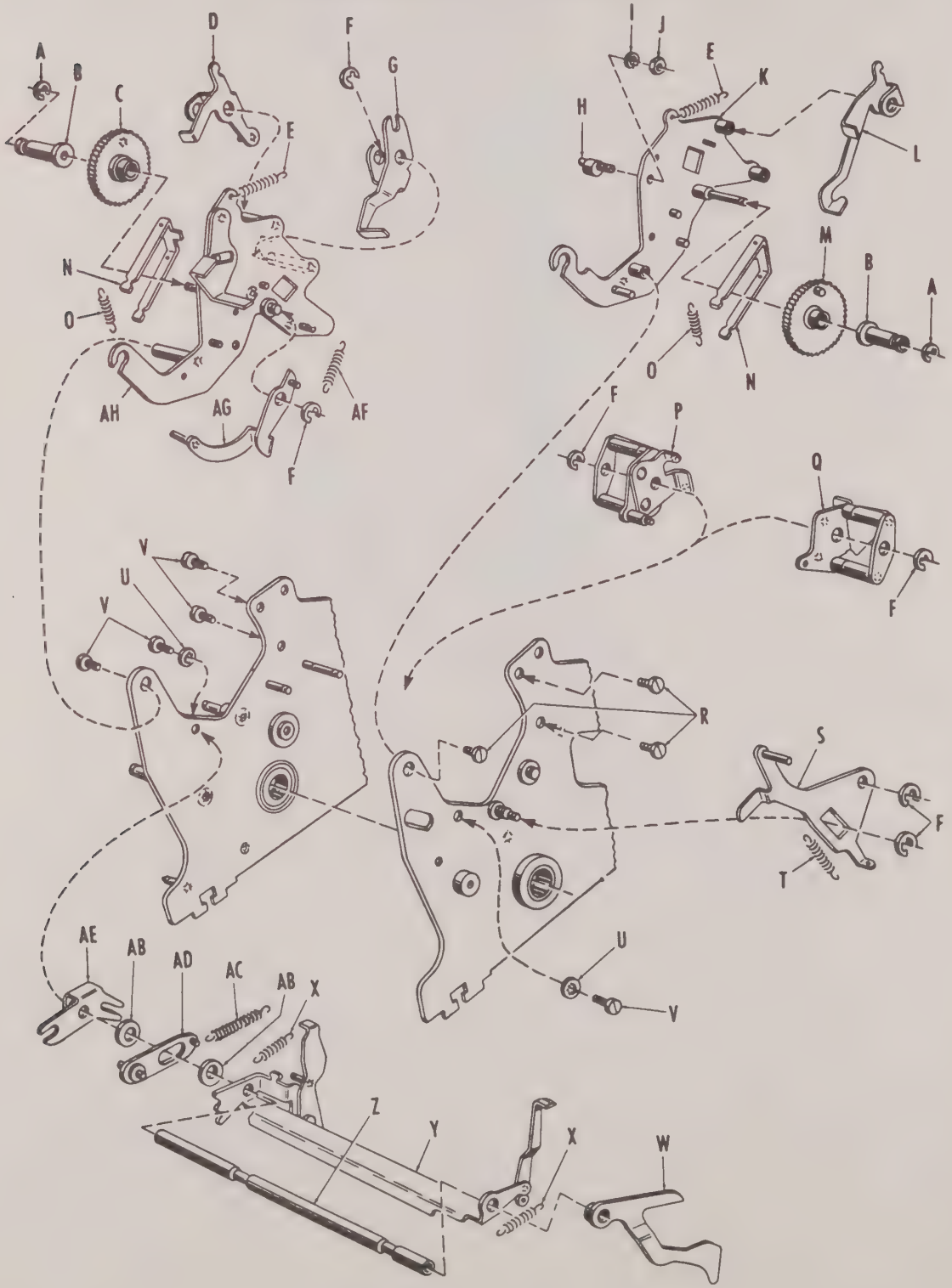
Carriages

PART NUMBERS (Plate 3)

A 46½ hex. nut
B 2JC55 detent driver assembly
C JX65 eccentric screw
D JX257 spring
E JT64 normalising lever
F X60-132 screw
G 1JT63-1 shown, after J66358D; 1JT63 before J66359D — lever
H 1JT53 space detent
I 1JD127 link. before J66359D use X133-105 clip
J X133-107 clip
K 81503½ screw
L 79810 spring
M 1JT54 selector arm
N JT33-1 shown, after J56296D; JT33 before J56297D — feed pawl control link
O 89806 spring
P X10-309 washer
Q 1JT62 use before machine J66359D; 1JT62-2 use after machine J66358D — selector arm
R X133-105 clip
S 1JD128-1 disengaging cam
T 84818 spring
U X57-4 eccentric
V 2854½ screw
W JC40 screw
X 9086 spring
Y 3280½ spring
Z 2JC33-5 shown, after J66358D; 2JC33-4 before J66359D — spacing sector
AB JC47 eccentric screw, use 613½ washer
AC 1JC13-1 shown, after J56296D; 1JC13 before J56297D, also J289 machines — spacing pawl
AD JR22 restoring arm

Carriages

RIBBON FEED MECHANISM (Plate 4)



PART NUMBERS ON NEXT PAGE

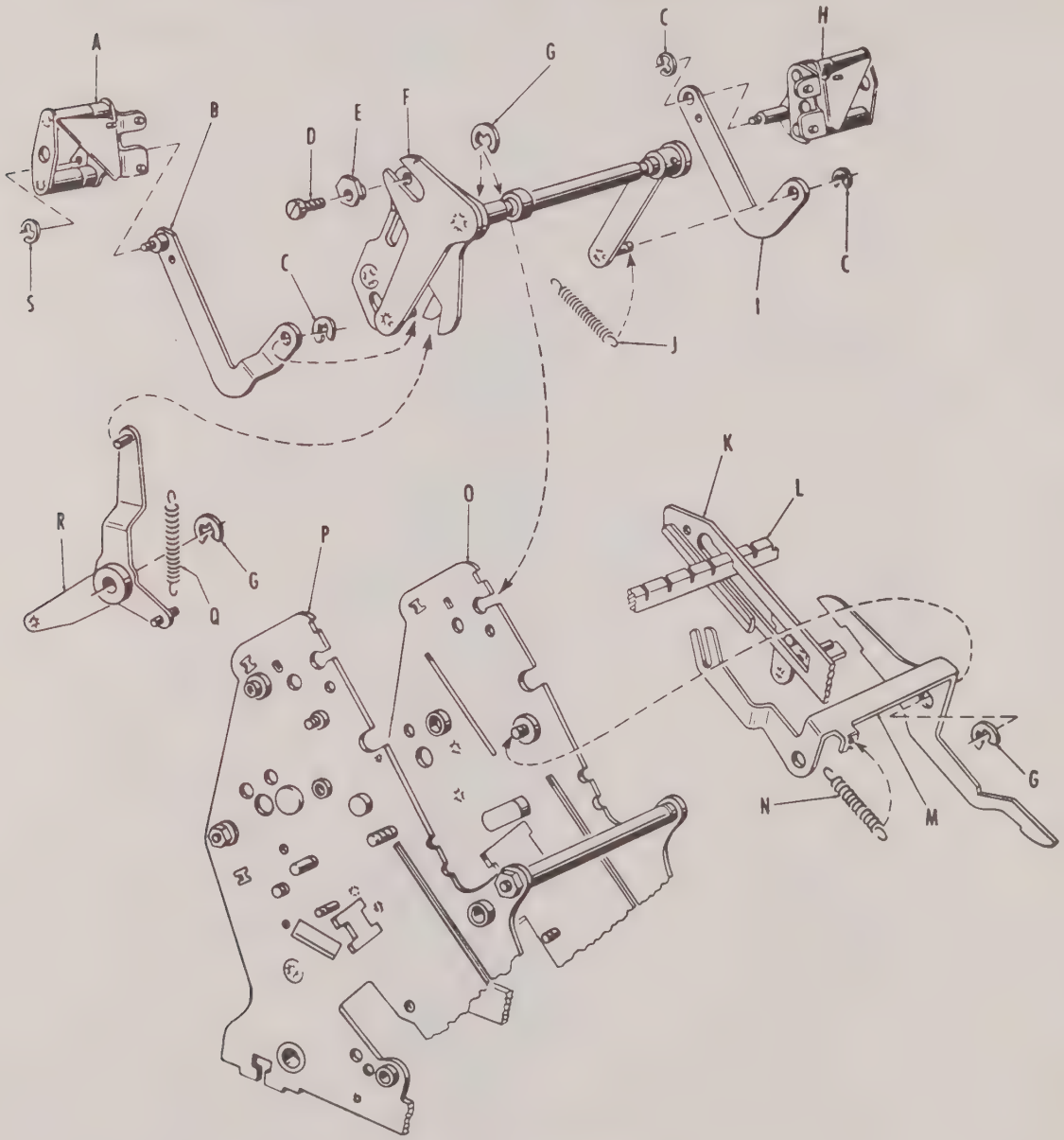
Carriages

PART NUMBERS (Plate 4)

A X133-105 clip
B **JR17** shown; **X10-67** for J289 machines — ribbon spool bearing
C **1JR9** right ratchet wheel
D **1JR4-2** shown, after J56296D; **1JR4** before J56297D — ribbon ratchet pawl
E **3480½** spring
F **21 No. 26** clip
G **JR5-1** shown, after J56296D; **JR5** before J56297D — pawl latch
H **JR20** eccentric screw
I **X275-5** lockwasher
J **46** nut
K **1JR110-1** before J56297D; **1JR110-7** after J56296D — left side frame
1JR110-8 before J121885D; 1029 0930 after J121884D; 1JR110-15 for Series J 400 — Style J289 left side frame
L **JR4-3** shown, after J56296D; **JR4-1** before J56297D — ribbon ratchet pawl
M **1JR9-1 left ratchet wheel**
N **JR10 flat brake spring**
O **83822 spring**
P Use **1JR11-9** guide, **1JT61-4** link and **21 No. 24** clip on machs. before J133838D; **1JR11-9** guide, after J133837D — see **Plate 6** for other styles
Q **1JR11-8 left ribbon guide**
R **X60-242 screw**
S **1JR16-4** shown, after J56296D; **1JR16** before J56297D — ribbon tension arm
T **89806 spring**
U **1097 1/16 lockwasher**
V **X60-31 screw**
W **1JD138 restoring arm**
X 77802 spring on right
707800 spring on left
Y **1JR8** before J56297D; **1JR8-1** after J56296D; **1JR8-2** for J289 machs. after J121884D — ribbon reverse bail
Z **JB2-2 ribbon reverse bail shaft**
AB **127 fte. 213 washer**
AC 803 fte. 219 shown, spring
JX214 spring, use 79145 ring for Series J 400 machs.
AD **1JR6 ribbon reverse detent**
AE **JR7** shown, before J121885D; **JR7-1** after J121885D — ribbon reverse lever
AF **71803 spring**
AG **1JR16-2 ribbon tension arm**
AH **2JR110 before J56297D**
Use 1028 4156 sideframe, 1028 4164 pressure roll release bail & 1028 4065 plug between J56296D & J213036D; Use 1028 4156 sideframe after J213035D — right side frame
Use 1028 4149 sideframe, 1028 4164 pressure roll release bail & 1028 4065 plug before J217189D; Use 1028 4149 sideframe after J217188D — Style J289 right side frame

Carriages

RIBBON SHIFTING MECHANISM (Plate 5)

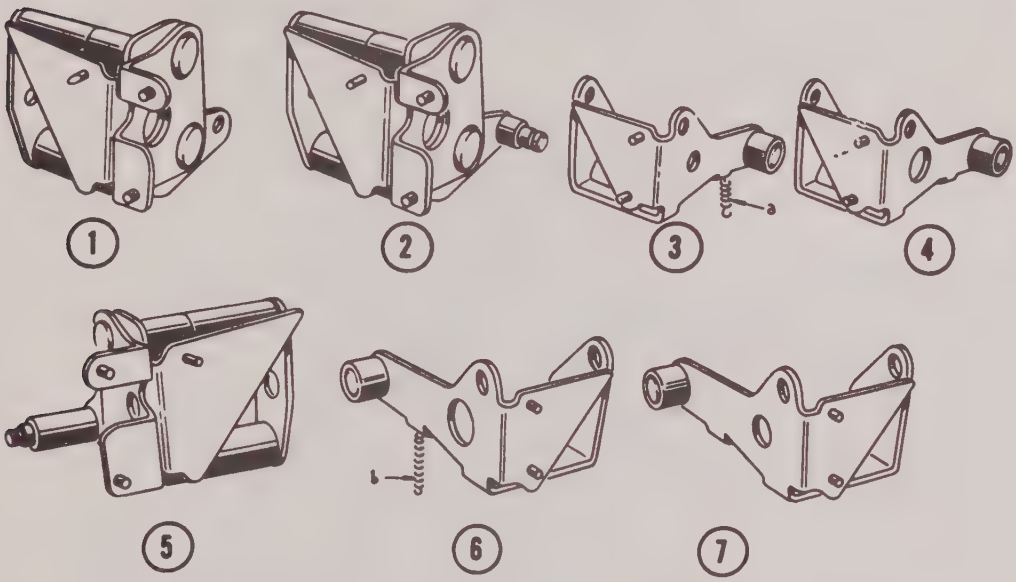


PART NUMBERS (Plate 5)

A	**1JR11-8** left ribbon guide, see **Plate 6,** for other styles	J	**74809 No. 1** spring
B	**1JT61-3** shown, after J74501D } link **JT61-1** before J74502D }	K	Use **1JT118-65 & JT60-3** on machs., before J147961D **1JT118-65** symbol bar on machs., after J147960D See **Plate 19,** for other styles
C	X133-105 clip	L	**JT16-1** type bar guide
D	**84631¼** screw	M	**JT60-3** selector bail
E	**X10-30** eccentric bushing	N	**X80-24** spring
F	**1JT55** shaft assembly	O	**1JT110-11** right adding section frame } see **Plate 16,** for other styles
G	**21 No. 26** clip	P	**1JT110-6** left adding section frame } see **Plate 16,** for other styles
H	Use **1JR11-9** guide, **1JT61-4** link and **21 No. 24** clip on machs. before J133838D **1JR11-9** right ribbon guide after J133837D See **Plate 6,** for other styles	Q	**69801** spring
		R	**1JD130** (shown) before J178632D } power arm **1JD130-1** after J178631D }
I	Use **1JT61-4** link, **1JR11-9** guide and **21 No. 24** clip on machs. before J133838D **1JT61-4** link, after J133837D	S	**21 No. 24** clip

Carriages

RIBBON GUIDE CHART (Plate 6)

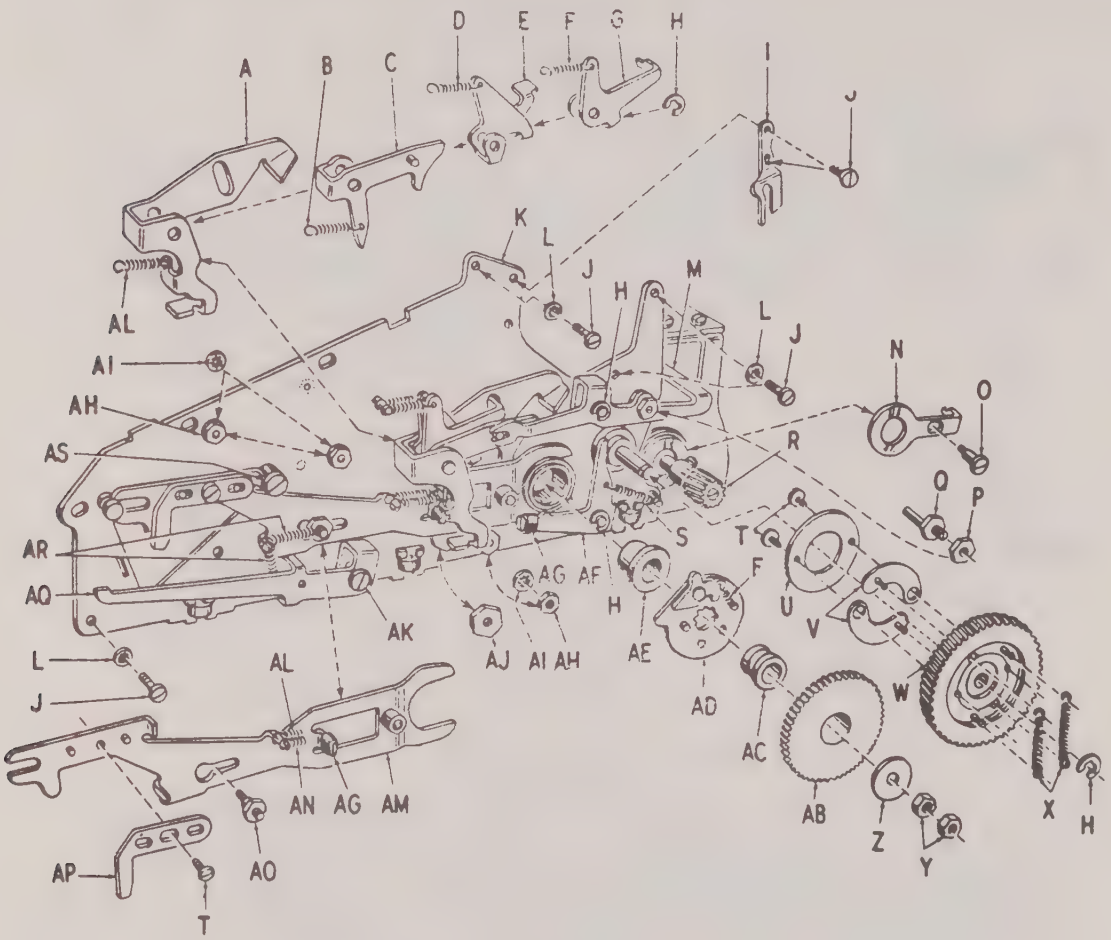


PART NUMBERS (Plate 6)

REF.	DESCRIPTION	PART NUMBER
1	Left guide for machines after J74501D	1JR11-8
2	Left guide for machines between J56296D and J74502D	1JR11-4
3	Left guide for machines before J56297D	1JR11-1
4	Left guide for Style J289 machines	1JR11-5
5	Right guide, used on machs. **after J133838D**	1JR11-9
	Parts on machs. **before J133837D** are as follows: **1JR11-9, 1JT61-4 and 21 No. 24**	
6	Right guide for Style J289 machines	1JR11-6
7	Right guide for machines before J56297D	1JR11
a	Spring for guides Nos. 3, 4, & 7	2887½
b	Spring for guide No. 6	53804

Side Frames

RIGHT SIDE FRAME ASSEMBLY (OUTER VIEW) (Plate 10)

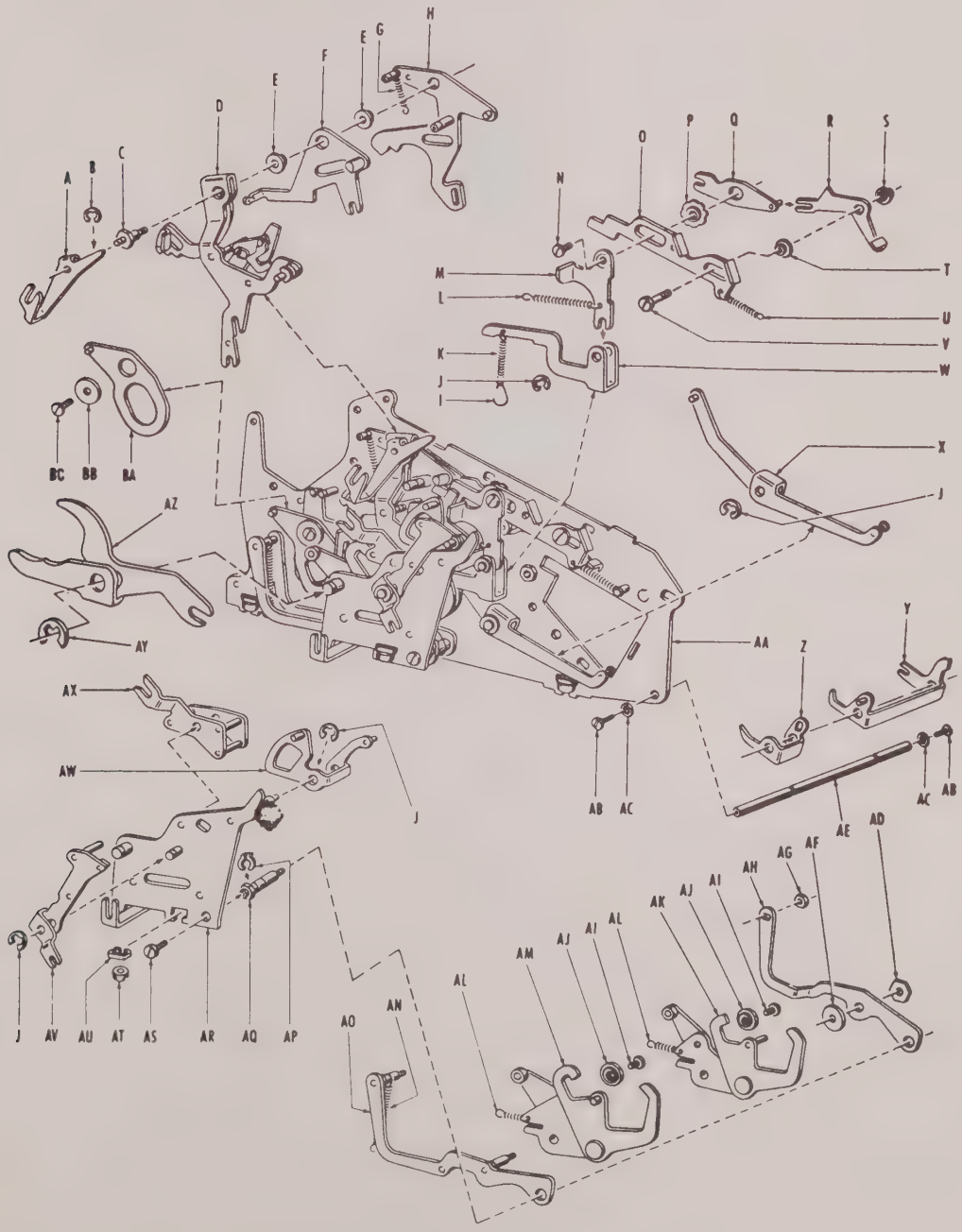


PART NUMBERS (Plate 10)

A	**JD18** clutch release arm
B	**79824** spring
C	**1JD61-4** retaining arm for switch points
D	**10686½** spring
E	**JD63** latch for total lever
F	**83802** spring
G	**JD19** latch for subtract lever
H	**21 No. 26** clip
I	**JD126** guide
J	X60-31 shown, screw JX262 screw, use JX263 rubber collar, Series J 400
K	**1JB110** right side frame, see **Plate 15**, for other styles
L	**1097 11/64** lockwasher
M	1JD55-1 shown, machs with J or J2 mtrs. } switch arm 1JD55-4 machs. with J3 mtrs. }
N	**JM24** bearing retainer
O	**X60-117** shoulder screw
P	**X30-28** nut
Q	1026 4257 eccentric screw
R	**JD54** pinion gear, use **JX39** set screw
S	69807 Style 13 spring
T	702655 screw
U	No longer required, use ref. T
V	**1JD86** arm
W	**1JD57-1** gear assembly only **2JD57-1** complete safety clutch gear assembly, includes T, U, V, W, X
X	**X80-56** springs
Y	**X30-6** hex. nut
Z	**X1-12** washer
AB	**1JD4** drive clutch gear
AC	**X10-50** bushing
AD	**2JD3** cam for restoring drive trip
AE	**X10-49** bushing
AF	**JD59** detent
AG	**X95-5** rubber bumper
AH	**45¼** nut
AI	**X275-23** lockwasher
AJ	293446 No. 2 shoulder nut
AK	**X30-4** threaded bushing, use **10025¼** No. 3 washer
AL	**72826** spring
AM	**1JD16** drive trip slide
AN	**X80-71** spring
AO	**X52-10** hex. head spring stud
AP	**JD84** adjustable stop arm
AQ	**JD17** latch for drive trip slide
AR	**63800** spring
AS	X60-32 shoulder screw, use 1029 5145 rubber bumper

Side Frames

RIGHT SIDE FRAME ASSEMBLY (INNER VIEW) (Plate 11)



PART NUMBERS ON NEXT PAGE

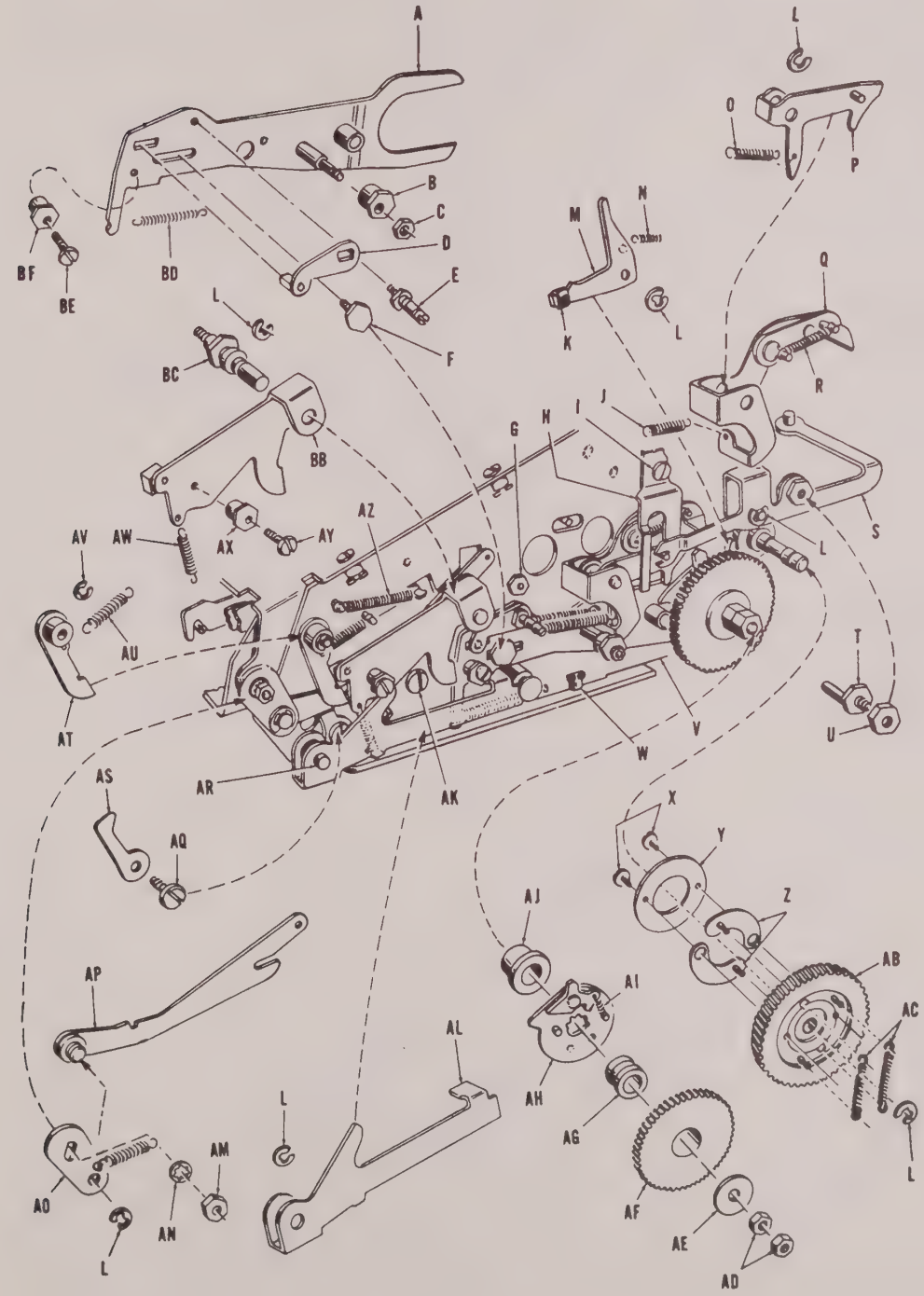
Side Frames

PART NUMBERS (Plate 11)

A JD53 symbol indexing arm
B X133-165 clip
C X60-41 hex. spring stud
D 2JD42-1 shown, with minus bal. } secondary
1JD42-1 without minus bal. before J20726D } total lever
1JD42-2 without minus bal. after J20725D }
E X10-61 flanged collar
F 1JD41 primary total lever
G 480¼ spring
H 1JD40 listing lever
I 23 No. 73A spring anchor
J 21 No. 26 clip
K X80-29 spring
L 81814 spring
M JD80 keyboard support
N X60-35 screw
O JD33 interlock slide
P JD89 eccentric shoulder collar
Q 1JD26 secondary minus lever
R JD24 primary minus lever
S X10-63 double flanged collar
T X10-62 shoulder collar
U 483 spring
V X60-42 screw
W JD81 centralizer
X 1JD23 intermediate keyboard shutter disabling lever
Y 1JD28 interlock bail
Z JD28-1 bail to disable intermediate keyboard shutter
AA 1JB110 right side frame assembly, see Plate 15, for other styles
AB X60-31 screw
AC 1097⅜ lockwasher
AD 203446 No. 2 hex. nut
AE JB2-2 tie shaft
AF FC320 brass space washer
AG 46⅛ nut
AH JD82 safety arm
AI X60-40 screw
AJ X10-60 eccentric
AK 2JD8 listing hook
AL 10734 spring
AM 2JD8-1 total hook
AN X80-46 spring
AO 1JD83 safety arm
AP 21 No. 10 clip
AQ X45-33 hex. headed post
AR 2JD21-1 auxiliary side frame
AS X60-157 screw
AT 82300 slotted nut
AU 82107¼ clip
AV 1JD52-2 shown, after J20725D } minus bal. } total lever block
1JD52 before J20726D } minus bal. } total lever block
1JD52-1 without minus bal. } total lever block
AW 1JD39 subtract symbol indexing lever
AX 1JD11 accumulator meshing cradle
AY XS-6 clip
AZ JD27 cipher block lever
BA 1JB13-1 ribbon feed lever
BB X1-32 flat washer
BC 73612 screw

Side Frames

RIGHT SIDE FRAME ASSEMBLY—STYLE 3 (OUTER VIEW) (Plate 12)



PART NUMBERS ON NEXT PAGE

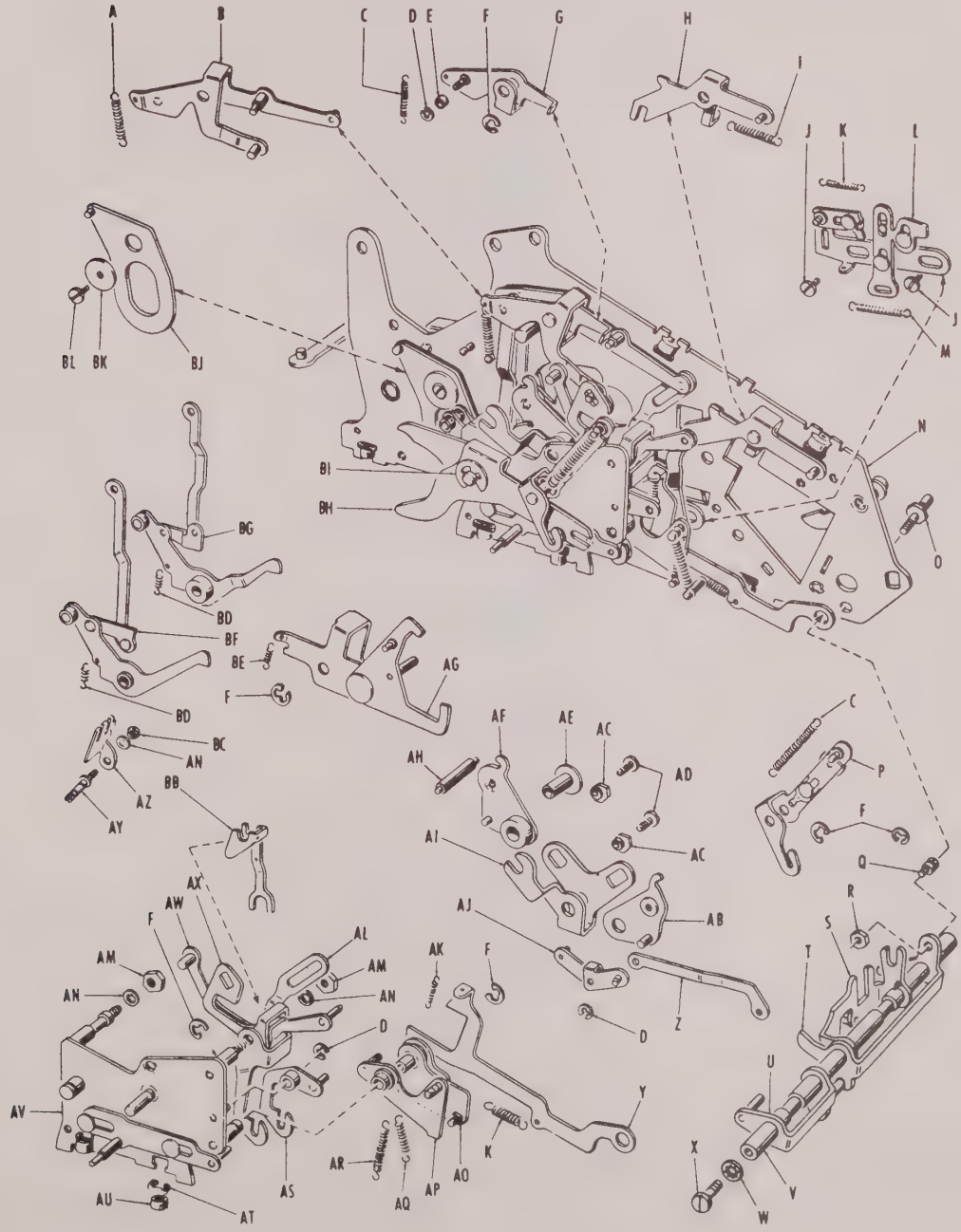
Side Frames

PART NUMBERS (Plate 12)

A 1JD16-3 shown; 1JD16-6 Series J 400 } motor trip slide
B JD139 eccentric
C 46 nut
D 1JD118-2 plate
E JD165 spring post
F JD140 screw
G 45 1/4 nut, use X275-23 lockwasher
H JD128 guide
I X60-31 screw
J 72828 spring
K X95-5 rubber bumper
L 21 No. 26 clip
M 1JD59-1 detent
N 69807 Style 13 spring
O 988 spring
P 1JD61-4 switch timer
Q 1029 0799 clutch dog stop
R 72828 spring
S 1JD55-1 shown, mchs. with J or J2 motors; 1JD55-4 mchs. with J3 motors } switch arm
T 1026 4257 eccentric screw
U X30-28 nut
V See Plate 15
W 82300 slotted nut, use 82107 1/4 clip
X 702655 screw
Y No longer required, use Ref. X
Z 1JD86 arm
AB 1JD57-1 gear assembly only
2JD57-1 complete gear & safety clutch includes X, Y, Z, AB & AC
AC X80-56 spring
AD X30-6 hex. nut
AE X1-12 washer
AF 1JD4 drive clutch gear
AG X10-50 bushing
AH 2JD3 cam for restoring drive trip
AI 83802 spring
AJ X10-49 bushing
AK X60-34 screw, use 1097 13/16 lockwasher
AL Use 1JD17-3 motor trip slide, 1JD16-3 slide, JX82 spring anchor, 84813 spring, 3688 spring, 1JK53-2 slide, JK15-2 arm and 780 (2 carbon) spring before J99431D
1JD17-3 motor trip slide after J99430D
AM 46 nut
AN X275-23 lockwasher
AO JK15-2 arm, use 780 (2 carbon) spring
AP 1JK53-2 trip slide
AQ 99573 screw
AR 1046 1226 hex post
AS JD124 lock hook
AT Use 1JD17-3 motor trip slide, 1JD16-3 slide, JX82 spring anchor, JB38 screw, 3688, 84813 and 1026 4414 springs
AU 83800A spring
AV X133-105 clip
AW 3486 1/2 spring
AX 406301 eccentric
AY 83639 screw
AZ 10085 spring
BB Use 1029 0773 driver, 20 No. 102 spring anchor, 3486 1/2 spring, 3688 spring, X57-7 eccentric, 1029 0799 clutch dog, 72828 spring (2 req.), 72806 spring and 1029 0781 right sideframe before J212387D
1029 0773 driver after J212386D
BC JD142-1 threaded post
BD 72806 spring
BE 2854 3/16 screw, use 20 No. 102 spring anchor
BF X57-7 eccentric

Side Frames

RIGHT SIDE FRAME ASSEMBLY—STYLE 3 (INNER VIEW) (Plate 13)



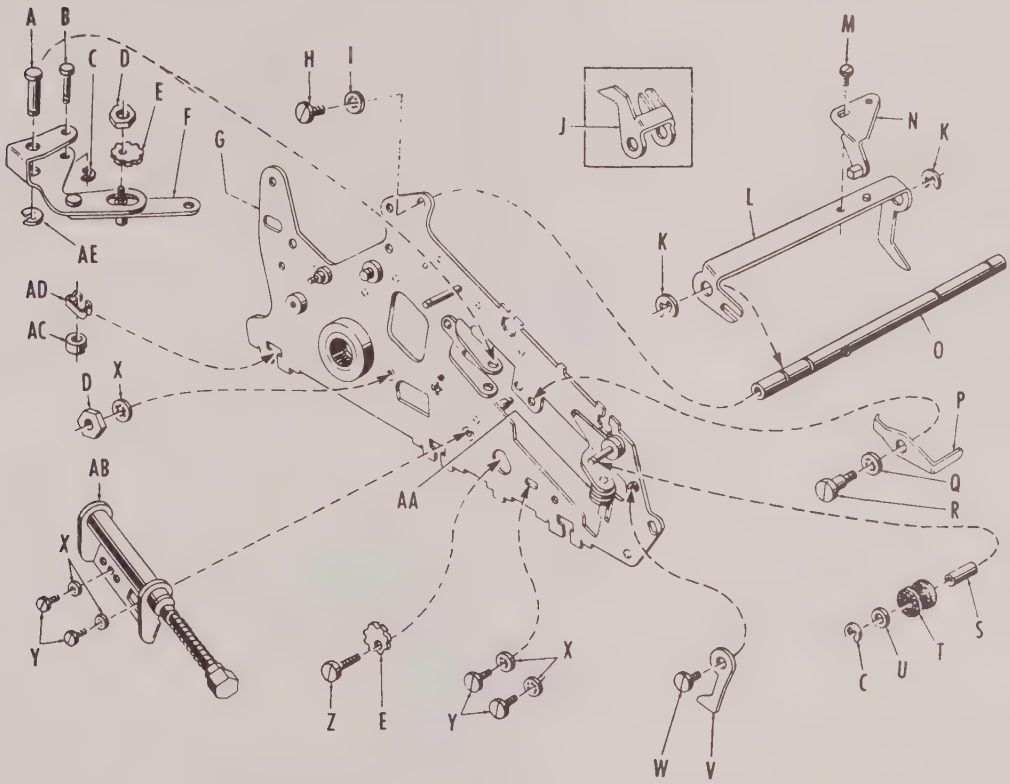
PART NUMBERS ON NEXT PAGE

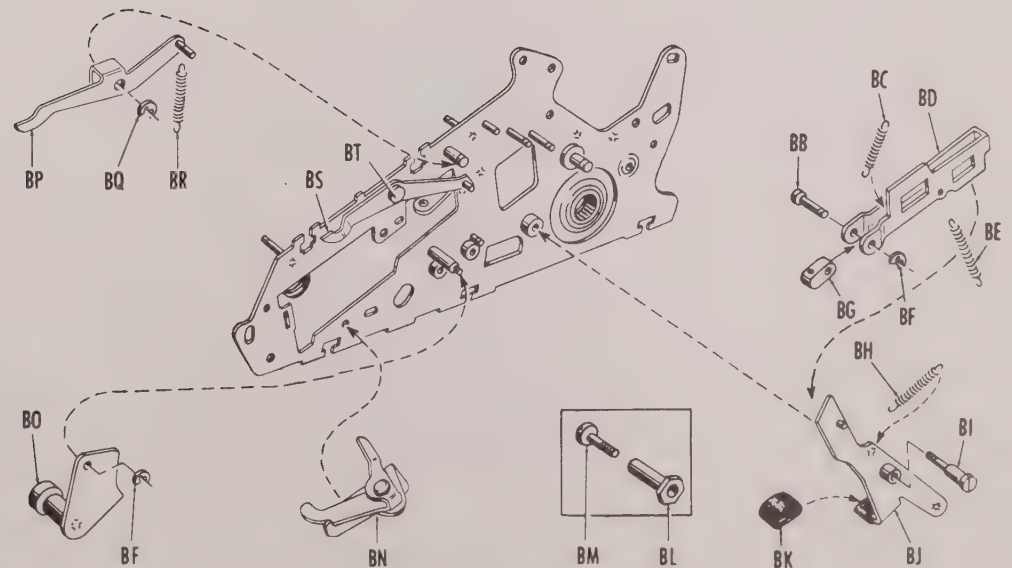
Side Frames

SYMBOL NUMBERS (Plate 13)

A 480B spring
B 1JD121 before J99944D } total
1JD121-1 after J99943D } control bail
C 15805 spring
D X133-105 clip
E 9835 roller
F 21 No. 26 clip
G 1JD122 list control bail
H 1JD120 shown } subtract index
1JD120-2 Series J400 } lever
I 10085 spring
J X60-236 screw
K 10180 spring
L 1JD107 minus index link
M 10686½ spring
N See Plate 15, for other styles
O 1046 1226 hex post
P 2JD52-4 minus balance lever
Q JD145-1 eccentric screw
R 46¼ nut
S 1JD125 keyboard interlock bail
T JD28-3 shutter lift bail
U 1JD153 shown, use before machs J103280D } bail assembly
1JD153-2 use after machs J103279D } bail assembly
V JB2-2 shaft
W 1097 13/16 lockwasher
X X60-31 screw
Y JD113 shown, used before J57224D and after J63447D } shutter lift arm
JD113-1 used between J57223D and J63448D } shutter lift arm
Z JD115 link
AB 1JD104 minus cradle arm
AC X57-20 eccentric
AD X60-36 screw
AE X10-250 bushing
AF 1JD104-1 plus cradle arm
AG 1JD97-1 cradle hook
AH JD96 post
AI JD119-1 accumulator mesh cradle
AJ 1JD114 subtract index bellcrank
AK 10784 spring
AL JD105 shutter index arm
AM 45¼ nut
AN X275-23 lockwasher
AO 2JD23-3 yielding joint assembly
AP 1JD111-2 shutter lift control
AQ X80-17 spring
AR 480¼ spring
AS 1JD112 arm
AT 82107¼ clip
AU 82300 slotted nut
AV 1026 4398 aux. side frame assembly
AW 1JD106 minus index bail
AX JD116 minus balance bellcrank
AY JD95 spring anchor screw
AZ JD110 guide
BB JD157 support
BC 46 nut
BD 10784 spring
BE 205806 spring
BF 2JD99-1 total driver arm
BG 2JD99 listing drive arm
BH JD27-1 shown, before machs J100031D } cipher block lever
JD27-2 after machs J100029D } cipher block lever
BI X5-6 c lip
BJ 1JB13-1 ribbon feed lever
BK X1-52 washer
BL 73612 screw

LEFT SIDE FRAME ASSEMBLY (OUTER) AND (INNER) VIEW (Plate 14)





SYMBOL NUMBERS ON NEXT PAGE

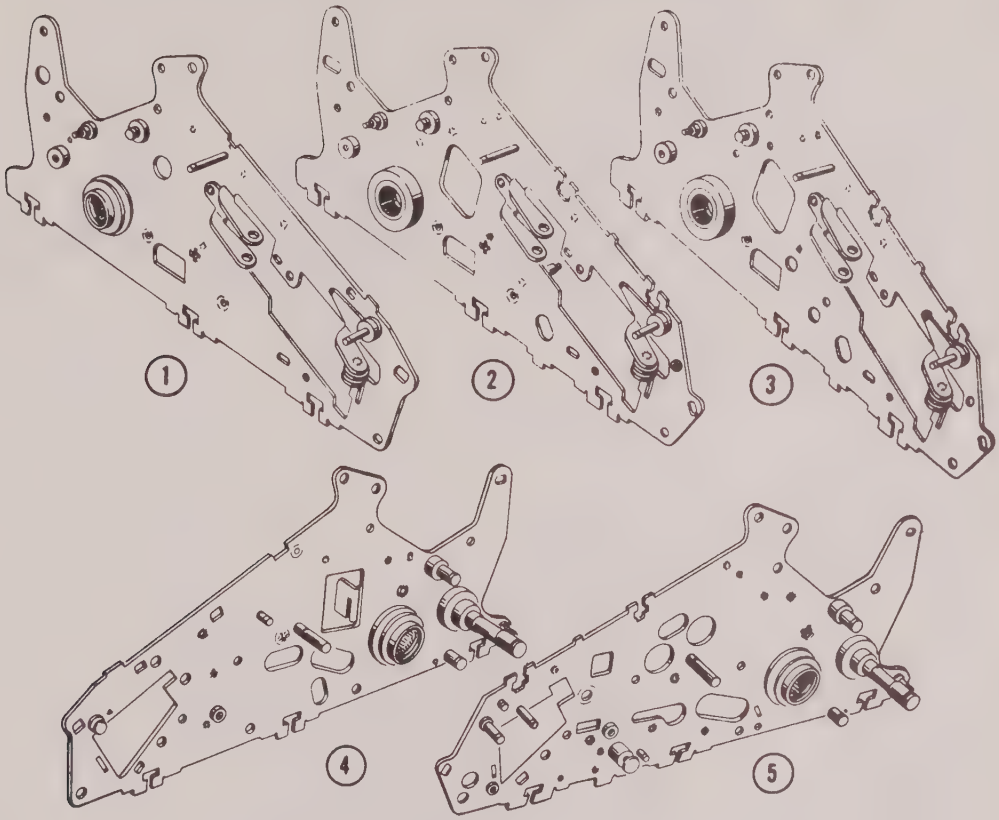
Side Frames

PART NUMBERS (Plate 14)

A **X50-146** pivot pin
B **X51-100** universal pivot pin
C X133-105 clip
D **45¼** hex. nut
E **X57-4** eccentric
F **1JD64-1** shown, intermediate keyboard restoring arm for Style 215 thru 224
1JD64-3 intermediate keyboard restoring arm for Style J289, use **JX189** rubber bumper
G Use 1JB110-18, 1JD43-4, JX253, 1JD3-43, JD3-42, 45 1/4, X275-4, X10-359, JX244, X10-358, JX224, 1JD130-1, 2JD85-8, 2JC117-13 and JB21-17 before J178632D
1JB110-18 left sideframe after J178631D
See Plate 15, for other styles
H X60-31 shown, screw
JX261 screw, use JX263 rubber collar - Series J 400
I **1097**11/64 lockwasher
J **JR15** cam bail for non add symbol before J56297D
K **X5-6** clip
L **1JD36-2** shown, after J56296D } non add bail
1JD36 before J56297D }
M **X60-35** screw
N **1JD154-1** arm
O **JB11-1** shown, after J56296D } tie shaft
JB11 before J56297D } tie shaft
JB11-3 Series J400 }
P **JS9-2** left limit stop
Q **1097**11/64 lockwasher
R **JX57** screw
S **X10-131** (.200 O.D.) } bushing
X10-231 (.250 O.D.) } bushing
T **JB14** rubber cushion only
1JB14 with **X10-131** bushing (.200 O.D.) } rubber cushion
1JB14-1 with **X10-231** bushing (.250 O.D.) } rubber cushion
U **200162**1/4 washer
V **JD124** lock hook
W **99573** screw
X **X275-23** lockwasher
Y **X60-36** screw
Z **2854**3/64 screw
AA **JB24** pulley, use **83515**1/2 screw, **45**1/4 nut—for field replacement only
AB **1JD70** air pot assembly
AC **82300** slotted nut
AD **82107**1/4 clip
AE **21 No. 26** clip
BB **X51-100** universal pivot pin
BC X80-24 spring
BD 1025 3565 intermediate keyboard restoring link
BE **3280**1/8 spring
BF X133-105 clip
BG JD78 before J190178D } universal
JD78-1 after J190177D } universal
BH **89806** spring
BI **JX253** shoulder screw
BJ 1JD43 before J56297D } intermediate keyboard restoring lever
1JD43-1 (shown) between J56296D & J178632D } intermediate keyboard restoring lever
1JD43-4 after J178631D } intermediate keyboard restoring lever
BK 1029 5145 rubber bumper
BL **JD236** shoulder nut } used for repairs when replacing BJ
BM **73659** screw } used for repairs when replacing BJ
BN **1JD76** air pot arm
BO **1JD128-1** disengaging cam
BP **1JD35-1** non add key lever
BQ **21 No. 26** clip
BR **8381** spring
BS **1JB20-1** shown } repeat key lever
1JB20-2 Series J400 } repeat key lever
BT **X50-99** rivet

Side Frames

MACHINE SIDE FRAMES (Plate 15)

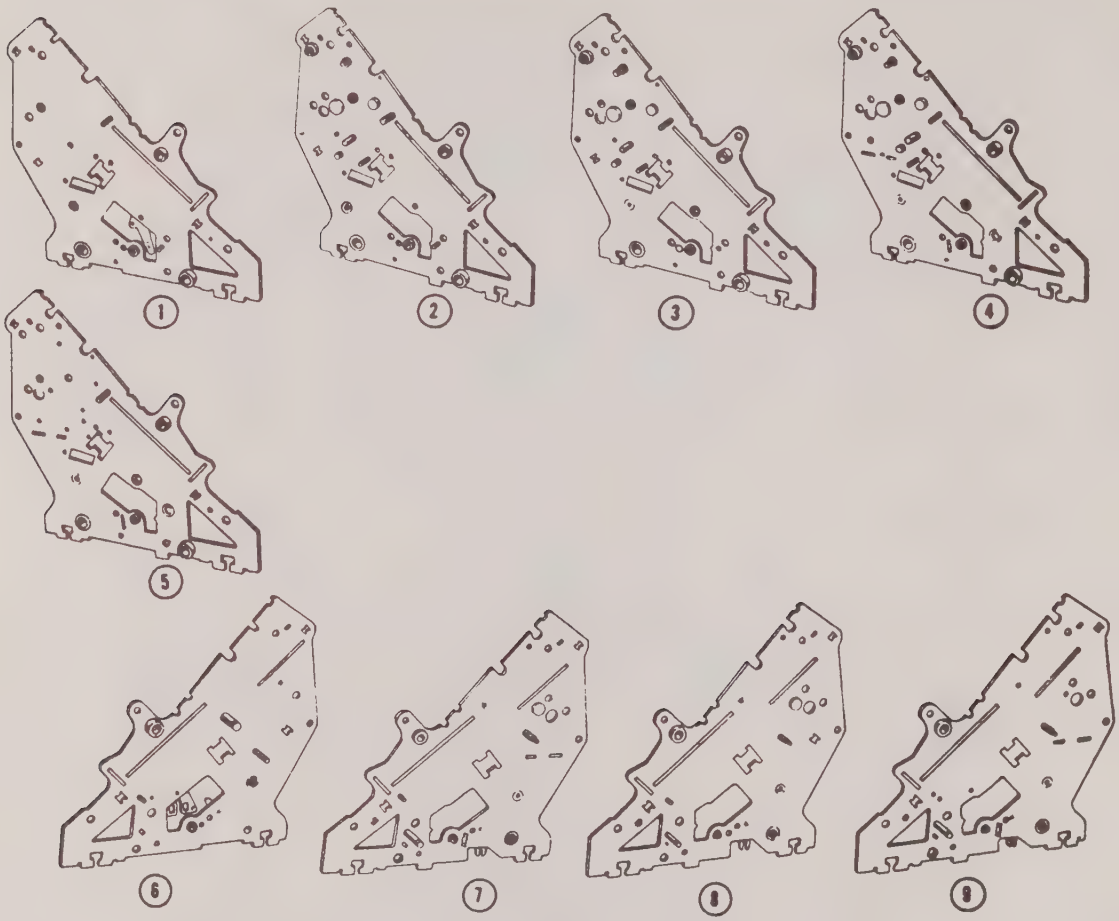


PART NUMBERS (Plate 15)

REF.	DESCRIPTION	PART NUMBER
1	Left side frame for machines before J56297D	1JB110-1
2	Left side frame, shown, used on machs. after J178631D Parts used on machs. between J56297D and J178632D are as follows: 1JB110-18, 1JD43-4, JX253, 45 1/4, X275-4, 1JD3-43, JD3-42, X10-359, JX244, X10-358, JX224, 1JD130-1, 2JD85-8, 2JC117-13 & JB21-17	1JB110-18
3	Left side frame for Series J 289 & J 290's (shown) used on machs. after J178631D Parts used on machs. before J178632D are as follows: 1JB110-19, 1JD43-4, JB21-18, 1JD85-7, 2JC117-12, JX253, 45 1/4, X275-4, 1JD3-43, JD3-42, X10-359, JX244, X10-358 & JX224	1JB110-19
4	Right side frame for machines before J56297D	1JB110
5	Right side frame for machines between J99430D and J210923D Parts used on machs. between J56296D and J99431D are as follows: 1029 0765, JK15-2, JX194, JX82, JB38, 1JD16-3 1JD17-3, 3688, 84813, 1026 4414	1029 0765
6	Right side frame for machines after J212386D (part not illustrated; Parts used on machs. between J210922D and J212387D are as follows: 1029 0781, X57-7, 20 No. 102, 3486 1/2, 3688, 1029 0773, 1029 0799	1029 0781
7	Left side frame for Series J 400 machines (part not illustrated)	1JB110-17

Side Frames

ADDING SECTION SIDE FRAMES, RIGHT AND LEFT (Plate 16)



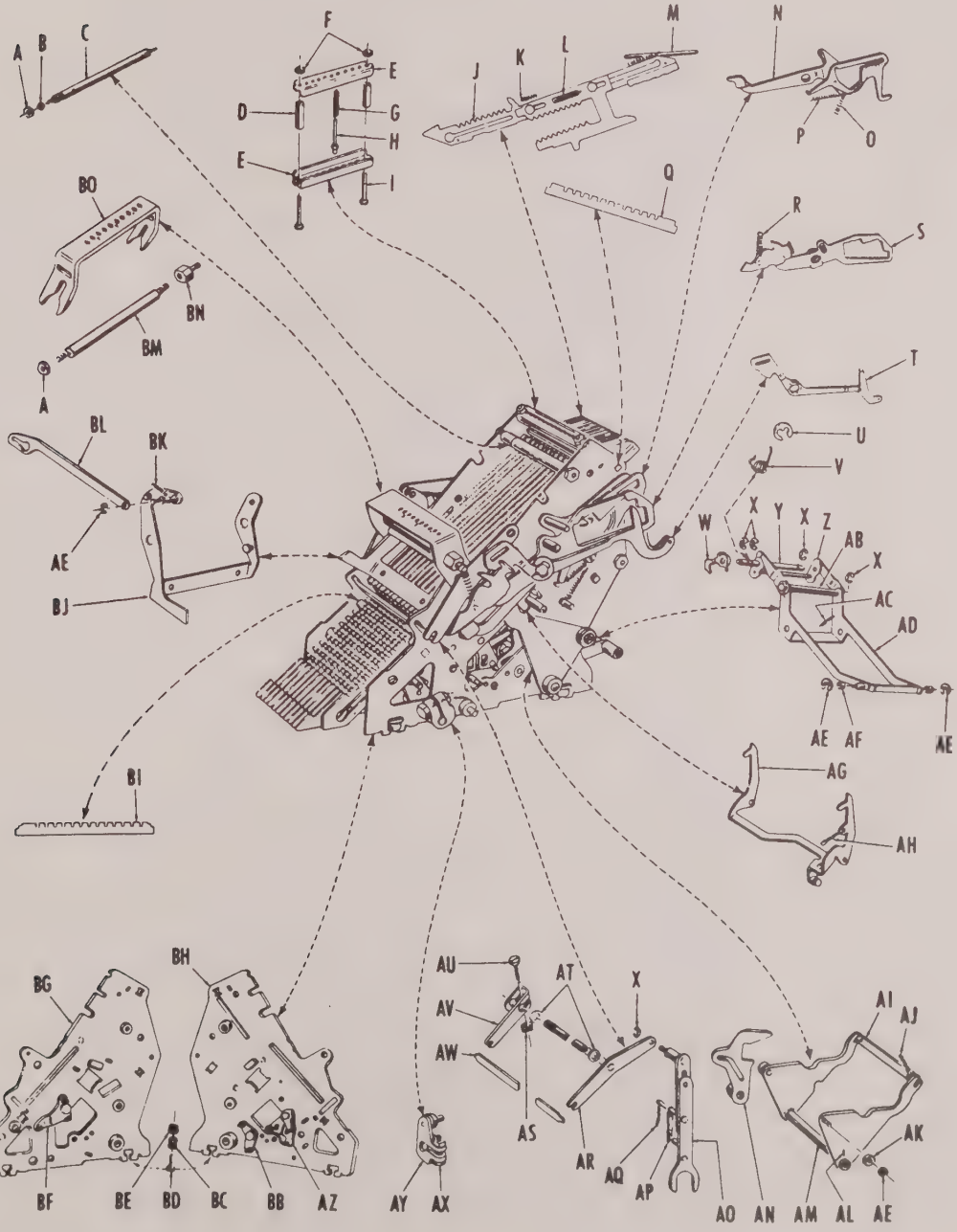
PART NUMBERS (Plate 16)

NOTE: When replacing the right side frame on machines after J56297D with 1JT110-11 (shown as Ref. 8), it will be necessary to install 2JT26-3 detent, JX71 eccentric, X60-161 screw.

REF.	DESCRIPTION	PART NUMBER
1	Left frame used on machines before J56297D	1JT110-1
2	Left frame used on machines between J56296D and J66359D	1JT110-5
3	Left frame used on machines between J66358D and J93465D	1JT110-6
4	Left frame, shown, used on machines after J161477D. Parts used on machines between J93464D and J161478D are as follows: 1JT110-28 left frame, JT15-2 guide comb, JT129 lock plate, JX228 limit screw, 84631 3/4 screw, X275-23 lockwasher (2 req.), 46 nut (2 req.) & JT16-1 type bar guide.	1JT110-28
5	Left frame for J 289 only, shown, used on machines after J178677D. Parts used on J 289 machines before J178678D are as follows: 1JT110-31 left frame, JT15-2 guide comb, JT129 lock plate, JX228 limit screw, 84631 3/4 screw, X275-23 lockwasher (2 req.), 46 nut (2 req.), & JT16-1 type bar guide.	1JT110-31
6	Right frame used on machines before J56297D	1JT110-3
7	Right frame, shown used on machines after J114076D Parts used on machines between J93464D and J114077D are as follows: 1JT110-32 and JT16-1	1JT110-32
8	Right frame used on machines after J56296D thru J93465D	1JT110-11
9	Right frame for Series J 289 only, shown, used on machines after J114949D Parts used on machines before J114950D are as follows: 1JT110-33 and JT16-1	1JT110-33

Side Frames

ADDING SECTION—BEFORE J56297D (Plate 17)



PART NUMBERS ON NEXT PAGE

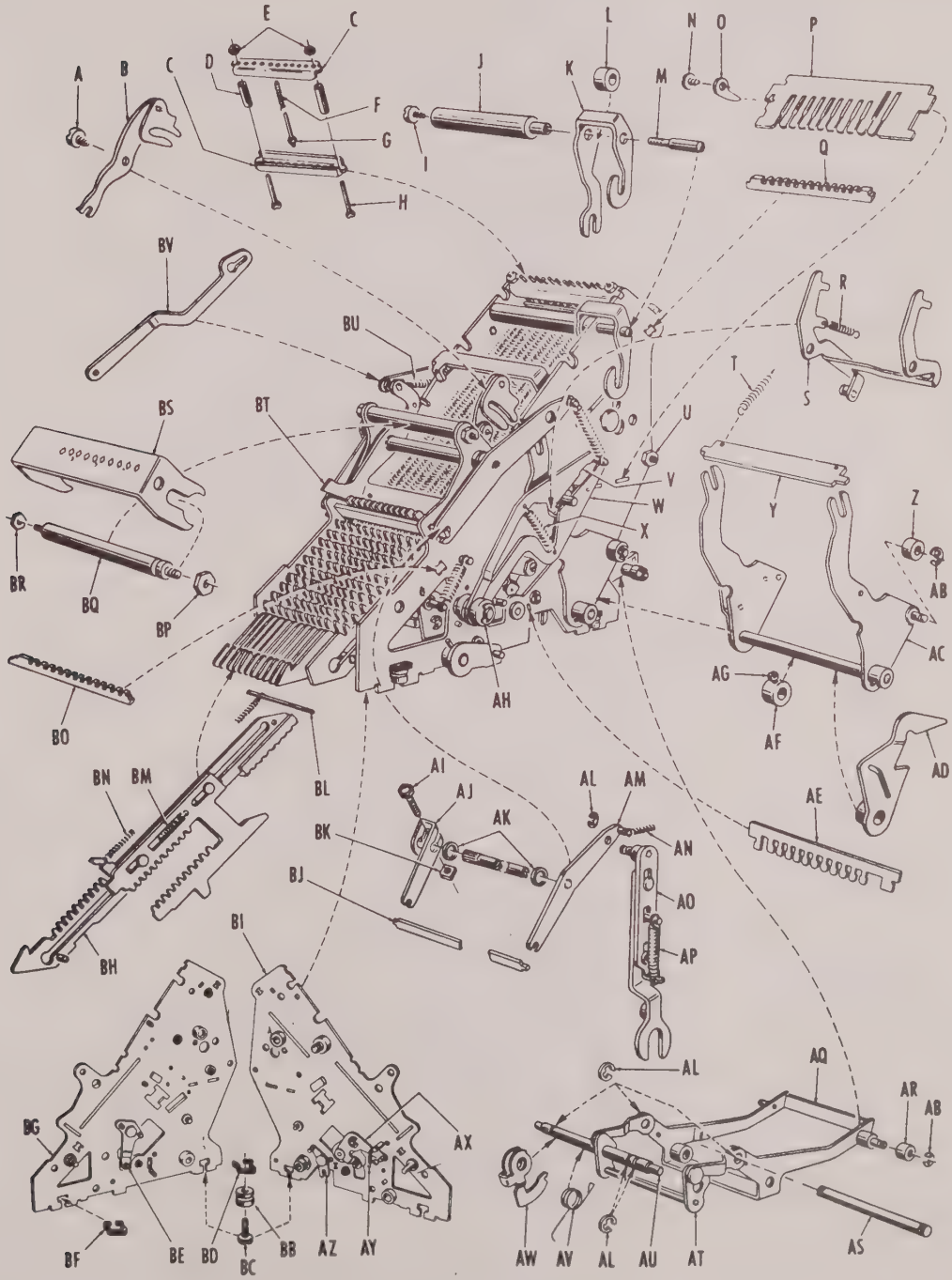
Side Frames

PART NUMBERS (Plate 17)

A 46¾ nut
B X275-23 lockwasher
C JT5-1 shown, after J24684D } tie shaft
JT5 before J24685D }
D X10-44 spacing collar (2 req.)
E JT17 cushion plate (2 req.)
F 46¼ nut
G X80-14 compression spring
H X36-3 cadmium plate (standard) }
X36-22 copper plate (short) } cushion pin
X36-23 black nickel (long) }
I X60-37 screw (2 req.)
J 1JT118-38 plain type bar, see **Plate 19**, for other styles
K 1026 4414 for listing type bars } spring
81814 for symbol type bars }
L X80-77 col. 1 only }
X80-26 last col., minus bal. mach. } adding rack spring
7680B all other cols. }
M JT4 spring anchor shaft
N 2JT32-1 symbol indexing segment
O 15805 spring
P 10686½ spring
Q JT16-1 type bar guide
R X80-96 spring
S 1JT32-6 shown, after J28725D } symbol indexing segment
1JT32-3 before J28726D }
T 1JT32-5 shown, auxiliary segment, minus bal. machs.
1JT32-7 auxiliary segment, not minus bal. machs.
U X5-6 clip
V JT48-1 torsion spring
W JT43-3 intermediate rack stop
X 21 No. 26 clip
Y JT37-3 shaft, use 76120 washer and 46 3/4 nut on mchs. before J83465D
Z 1JT40 adding rack stop bail
AB JT38-1 shown, after J41532D } shaft
JT38 before J41533D }
AC JX1 spring
AD 1029 9154 shown after J41532D } reset bail
1JT21 before J41533D }
AE X133-105 clip
AF 705339 .250 dia. cadmium plate }
X10-271 .260 dia. not plated } roller, use as required
X10-189 .270 dia. copper plate }
JX86 .280 dia. nickel plate }
AG 1JT22-1 accumulator locking bail
AH 73820 spring
AI JT14-1 shown, after J34734D } blade
JT14 before J34735D }
AJ 1026 4414 spring
AK X10-273 .375 dia. not plated }
X10-42 .387 dia. copper plate } roller (2 req.) use as
X10-113 .399 dia. cadmium plate } required
AL 8050¾ pin
AM 1JT2-1 type bar restoring frame
AN 1JT12 total stop cam
AO 2JT34 aligner arm
AP 81 ftc. 124 No. 2 spring
AQ X80-17 spring
AR 1JT18-1 aligner arm and shaft assembly
AS X30-23 nut
AT 1417 washer
AU X233-298 screw, use X275-135 washer
AV JT18 left arm
AW JT10 aligning blade
AX X60-123 hex. head screw, use X30-5 nut
AY 1JH5 cipher block actuating arm
AZ 1JT26 detent, use X50-125 rivet after J56296D use X133-107 clip
BB 1JT19-1 lever, use X50-377 rivet
BC X30-32 slotted nut
BD X60-157 screw for auxiliary base
BE 82107¼ clip
BF 1JT24 carry lever, use X50-124 rivet
BG 1JT110-1 left side frame, see **Plate 16**, for other styles
BH 1JT110-3 right side frame, see **Plate 16**, for other styles
BI JT15 front type bar guide
BJ 1JT20-1 type bar blocking bail, use 99331 (.34) collar
BK 84818 spring
BL JT33 spacing pawl control link
BM JT5 tie shaft
BN JT45 spring anchor nut
BO JT27-8 monetary punctuation } column indicator plate
JT27-9 no punctuation }

Side Frames

ADDING SECTION AFTER J56296D (Plate 18)



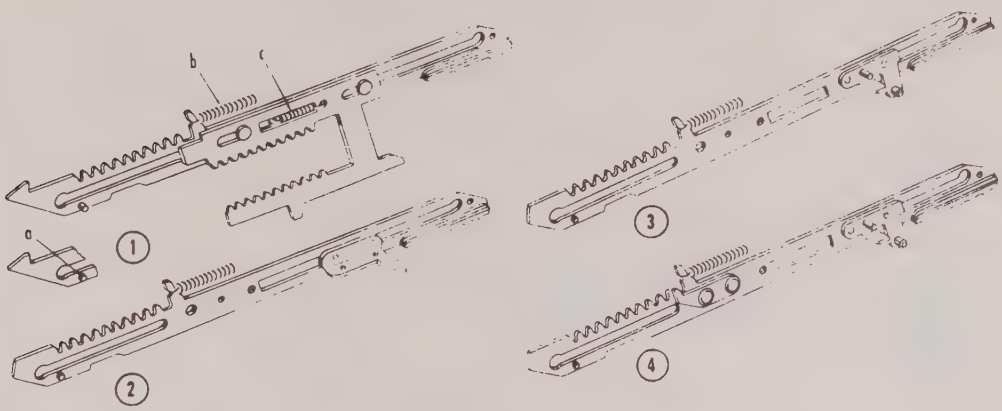
PART NUMBERS ON NEXT PAGE

Side Frames

PART NUMBERS (Plate 18)

A JX50 screw
B 1JT68 lever
C JT17 cushion plate (2 req.)
D X10-44 spacing collar (2 req.)
E 46¼ hex. nut
F X80-14 compression spring
G X36-3 cadmium plate (standard) } cushion pin
X36-22 copper plate (short) } cushion pin
X36-23 black nickel (long) } cushion pin
H X60-37 screw (2 req.)
I 12051¾ screw
J JT49 shaft
K JT50 symbol bail
L X10-251 spacer
M X45-46 screw post
N X60-157 screw
O JK28 lock arm
P JT71 comb
Q JT16-1 type bar guide
R 73820 spring
S 1JT22-1 accumulator locking bail
T JX21 spring
U JT5-1 tie shaft (shown) use 46 nut & X275-23 lockwasher before J56296D
Use JT5-5 shaft, JC4-5 shaft & 12051¾ screws on machs. between J56295D & J100944D
Use JT5-5 shaft on machs. after J100943D
V 1JT52 upper accumulator centralizer
W 1JT51 lower accumulator centralizer
X 702808 spring
Y JT14-1 blade
Z X10-347 .387 dia. copper plated } roller (2 req.) use as required
X10-348 .399 dia. cadmium plated } roller (2 req.) use as required
X10-349 .375 dia. not plated } roller (2 req.) use as required
AB X133-105 clip
AC 1046 1150 shown } type bar restoring frame
1046 1158 for J 289 machs } type bar restoring frame
AD 1JT12-2 shown, use before machs J100944D } total stop cam
1JT12-4 use after machs J100943D } total stop cam
AE JT72 comb
AF 1-74308 set collar, includes AG
AG 12055⅛ screw
AH X133-107 clip
AI X233-238 screw, use X275-135 lockwasher
AJ JT18 left arm
AK 1417 washer
AL 21 No. 26 clip
AM 1JT18-2 aligner arm and shaft assembly
AN 72806 spring
AO 2JT34-1 aligner arm
AP 84815A spring
AQ 1029 9188 after J93464D } reset bail
1029 9154 before J93465D } reset bail
AR 705339 .250 dia. cadmium plated } roller, use as required
X10-271 .260 dia. not plated } roller, use as required
X10-199 .270 dia. copper plated } roller, use as required
JX86 .280 dia. nickel plated } roller, use as required
AS JT38-1 shaft
AT 1JT40 shown, before J93464D } adding rack stop bail
1JT40-1 after J93463D } adding rack stop bail
AU JT37-2 shaft
AV JT48-3 torsion spring
AW JT43-1 intermediate rack stop
AX 2JT26-3 detent, use X133-105 clip
AY 283A spring
AZ 1JT19-3 lever, use X50-377 rivet
BB X30-32 slotted nut
BC JX41 screw
BD JT112 retaining clip
BE 1JT24-1 carry lever, use X60-246 screw
BF 82107¼ retaining clip
BG 1JT110-6 left side frame, see Plate 16, for other styles
BH 1JT118-38 plain type bar, see Plate 19, for other styles
BI 1JT110-11 right side frame, see Plate 16, for other styles
BJ JT10 aligning blade
BK X30-23 nut
BL JT4 spring anchor shaft
BM X80-77 col. 1 only } adding rack spring
X80-26 last col. minus bal. mach. } adding rack spring
7680B all other cols. } adding rack spring
BN 1026 4414 for listing type bars } spring
81814 for symbol type bars } spring
BO JT15-2 type bar guide
BP 45¼ nut
BQ JT5-1 tie shaft
BR 46¾ nut
BS JT27-8 monetary punctuation } column indicator plate
JT27-9 no punctuation } column indicator plate
BT 1JT20-1 type bar blocking bail, use 99331(34) collar
BU 84818 spring
BV JT33-1 spacing pawl control link

TYPE BAR CHART (Plate 19)



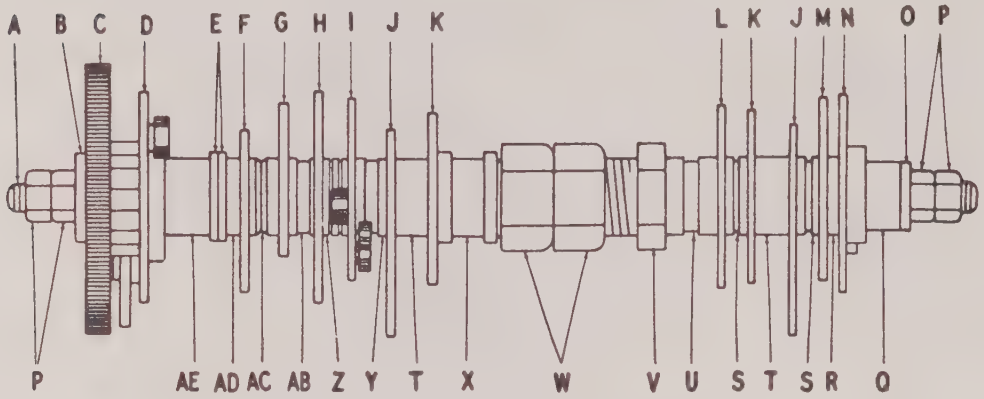
PART NUMBERS (Plate 19)

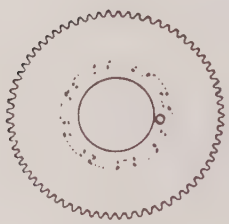
NOTE: Due to a change in the spring anchor of these type bars, a complete set including the symbol bar and restoring blade **JT14-1** must be installed when replacements are needed for machines prior to serial No. J34735D.

REF.	DESCRIPTION	PART NUMBER
1	0 thru 9 plain	**1JT118-38**
	.0 thru .9 period left	**1JT118-39**
	0. thru 9. period right	**1JT118-41**
	0, thru 9, comma right	**1JT118-40**
	,0 thru ,9 comma left	**1JT118-42**
2	Standard symbol bar used with indexing segments N,S,T, (Plate 17)	**1JT118-28**
	Option "A" symbol bar used with above segments	**1JT118-34**
3	Standard symbol bar used between J56296D and J63945D	**1JT118-35**
	Option "A" symbol bar for above machines	**1JT118-37**
4	Standard symbol bar used after J63944D; also use JT60-3 selector bail	**1JT118-65**
	Option "A" symbol bar used after J63944D; also use JT60-3 selector bail	**1JT118-66**
a	o thru 9 plain, used in Col. 1 only, after J91564D	**1JT118-55**
b	type bar restoring spring	
	for listing type bars	1026 4414
	for symbol bars	**81814**
c	adding rack spring	
	used in Col. 1 only	**X80-77**
	used in last Col., minus bal. machs.	**X80-26**
	used in all other cols.	**7680B**

Accumulation

CAMSHAFT ASSEMBLY (Plate 25)





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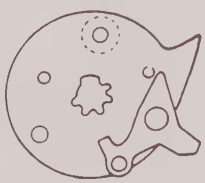


D

E

F

G

H

I

J

K

L

M

N

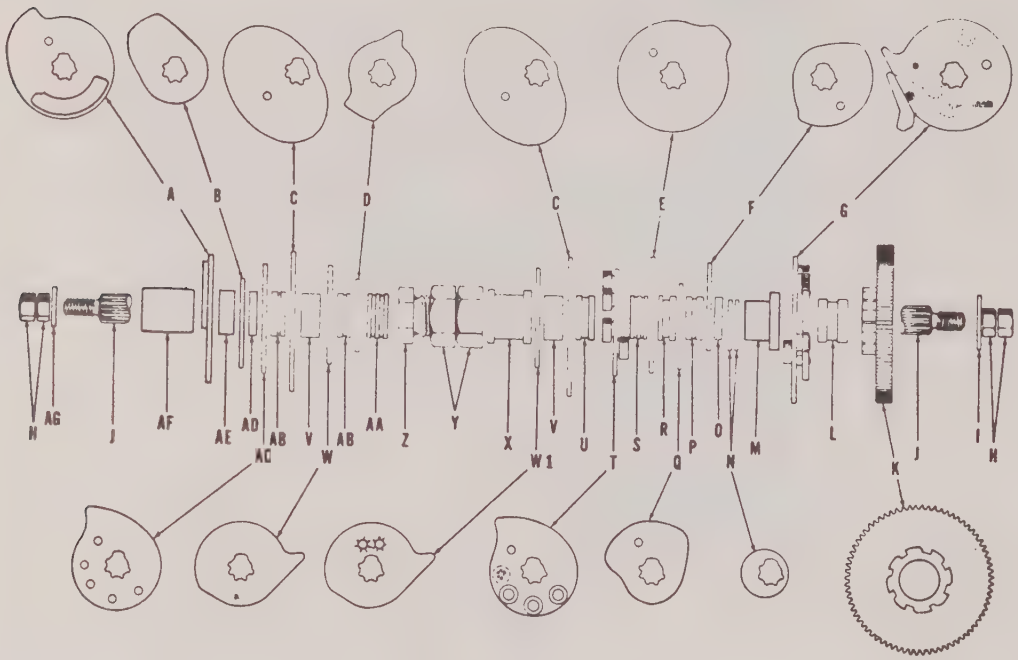
PART NUMBERS ON NEXT PAGE

Accumulation

PART NUMBERS (Plate 25)

A JD1 shaft
B X1-12 washer
C 1JD4 drive clutch gear
D 2JD3 cam for restoring drive trip
E JD3-1 cam for ribbon feed (2 req.)
F JD3-2 cam for listing hooks
G JD3-3 cam for total hooks
H JD3-4 cam for type alignment
I 1JD3-41 cam for cipher block and printing
J 1029 0716 cam for type bar restoring bail
K JD3-7 shown, cam for carry pawl and adding rack reset, before J100944D
JD3-29 cam for carry pawl and adding rack reset after J100943D
K1 1JD3-28 cam for carry pawl and adding rack reset and for carry bail latch
L JD3-8 cam for accumulator locking bail
M JD3-9 cam for printing (shown)
JD3-10 cam for restoring intermediate keyboard, use before mach. J24676D and not required after mach. J24675D
N 1JD3-18 use after mach. J24675D; 1JD3-11 use before mach. J24676D } cam for blocking listing keyboard, carriage restoring and platen feed pawl disengagement
O X1-11 washer
P X30-6 hex. nut (4 req.)
Q X10-207 (shown) use after mach. J24675D; X10-127 use before mach. J24676D } spacing collar
R Use JX223 spacing collar
S X10-56 spacing collar (grooved)
T X10-54 spacing collar (plain)
U X10-233 spacing collar (grooved)
V X60-39 variable spacing collar
W X30-9 hex. nut for variable spacing collar
X JX87 spacing collar
Y X10-53 spacing collar (grooved)
Z X10-48 spacing collar, 2 grooves
AB X10-48 spacing collar (grooved)
AC X10-51 spacing collar (grooved)
AD X10-55 spacing collar (plain)
AE X10-49 spacing collar (shoulder)

CAMSHAFT ASSEMBLY—STYLE 3 (Plate 26)



PART NUMBERS (Plate 26)

A	1JD3-18 before J178632D	restoring cam
	1JD3-43 between J178631D & J215110D	
	1029 0617 after J215109D	
B	JD3-17 before J178632D	red ribbon cam
	JD3-42 between J178631D & J215110D	
	1029 0625 after J215109D	
C	1029 0716 cam for type bar restoring bail	
D	JD3-8 before J215110D	cam for accumulator
	1029 0724 after J215109D	locking bail
E	JD3-4 before J215110D	cam for type alignment
	1029 0740 after J215109D	
F	JD3-13 before J215110D	list cam
	1029 0666 after J215109D	
G	2JD3 before J215110D	cam for restoring drive trip
	1029 0674 after J215109D	
H	X30-6 hex nut	
I	X1-12 washer	
J	JD1 shaft	
K	1JD4 drive clutch gear	
L	X10-50 bushing	
M	X10-49 shoulder spacing collar	
N	JD3-1 before J215110D	cam for ribbon feed
	1029 0690 after J215109D	
O	X10-55 plain spacing collar	
P	X10-51 grooved spacing collar	
Q	JD3-14 before J215110D	total cam
	1029 0658 after J215109D	
R	X10-48 grooved spacing collar	
S	X10-48 spacing collar (2 grooves)	
T	1JD3-41 before J215110D	cam for cipher block and
	1029 0708 after J215109D	printing
U	X10-53 grooved spacing collar	
V	X10-54 plain spacing collar	
W	JD3-7 before J100944D	
	JD3-2 between J100943D and J215110D	reset cam, for adding rack reset
	1029 0633 after J215109D	
W1	1JD3-28 before J215110D	reset cam, for carry bail
	1029 0732 after J215109D	latch
X	JX87 spacing collar	
Y	X30-9 hex nut	
Z	X60-39 spacing collar	
AA	X10-233 grooved spacing collar	
AB	X10-56 before J178632D	grooved spacing collar
	X10-358 after J178631D	
AC	JD3-9 before J215110D	printing cam
	1029 0641 after J215109D	
AD	JX233 before J178632D	spacing collar
	JX244 after J178631D	
AE	X10-287 before J178632D	spacer
	X10-359 after J178631D	
AF	JX224 spacer	
AG	X1-11 washer	

APPENDIX 4

Model 1453 Compatibility with Integrated Circuit Voltage Levels

(Used with Beckman Models 6148, 6155, 6200 and 6300 Series Instruments.)

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3.	Printer Control Module		2
4.	Four-Line Input Cable		2
5.	Model 1453 Printer Modification		2
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	IC Input Module Parts List		4
	IC Input Module Schematic Diagram	C525727-Rev. B	5
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	Printer Control Module Schematic Diagram	D525731-Rev. B	9
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APPENDIX 4

MODEL 1453 COMPATIBILITY WITH INTEGRATED CIRCUIT VOLTAGE LEVELS

1. IC INPUT MODULE

The IC Input Module is designed to interface the Model 1453 Printer to instruments having integrated circuit output voltage levels. This module is housed in the same mechanical package as the standard four-line input module, and plugs into the same input sockets without modification to the printer.

The schematic diagram (dwg. no. C525727), associated assembly drawings, and parts list of this module are shown on pages 3 through 6. A comparison of this schematic and the schematic of a standard Model 1453 four-line input module (dwg. no. B404461) shows that the coincidence comparator, two-stage trigger circuit and pawl magnet driver are identical in both units. A DTL (Diode-Transistor Logic) integrated circuit flatpack (Z1) has been added to serve as an input amplifier. The output of the four DTL gates is applied to simple inverting level changers (Q1 through Q4) which change the 0 to +5 volt integrated circuit logic levels to 0 to -14 volt levels for entry into the coincidence comparator circuit. The theory of operation of the remainder of the module is given in paragraph 3.5.2 of the Model 1453 Printer manual.

A physical layout of the IC Input Module (dwg. no. D525701) is shown on page 6.

The DTL flatpack (Z1) consists of four inverting NAND gates which serve to buffer the input lines and to provide some noise rejection. An input logic level of from 0 to +0.45 volt holds the NAND gate outputs at +5 volts. This keeps the level changer transistors (Q1 through Q4) turned off and thus presents -14 volt inputs to the coincidence comparator. This is equivalent to a logic zero in the case of the standard module.

A +2.5 volt to +5.5 volt input to the NAND gates holds their outputs to ground and permits the level changer transistors to turn on. This presents a 0 volt input (logic one in the standard module) to the coincidence comparator.

Therefore, the logical inputs to the IC Input Module are: a logic zero = 0 to +0.45 volt (the signal source must be capable of sinking 1.6 milliamps of current at these voltage levels); a logic one = +2.5 to +5.5 volts (the leakage current into the input terminal is a maximum of 5 microamps at these voltage levels).

Power for the DTL flatpack is derived from the +8 volts available on the module input connector. The +8 volts is applied to an emitter follower which has a resistor divider between collector and base. The ratio of R66 and R27 is set to provide a +5 volt output at the emitter of Q8.

To operate this module with inverted logic, i.e., a logic one = 0 to +0.45 volt and a logic zero = +2.5 to +5.5 volts, the DTL flatpack (Z1) can be removed and jumper wires inserted between pins 1 and 3, 4 and 6, 9 and 8, and 12 and 11 of the flatpack.

2. IC INPUT MODULE TEST PROCEDURE

The most straightforward method of testing the IC Input Module is shown in Figure 1. Inputs to the module are obtained from an RTL flatpack. To closely simulate the output of a Model 6148, 6200 Series or 6300 Series Counter, a Motorola CM 724P should be used. The inputs to this gate are controlled by four toggle switches. Connect the IC Input Module to the Model 1453 Printer and apply a print command pulse to the printer from a pulse generator. Test all digits from 0 through 9 by manipulating the four toggle switches.

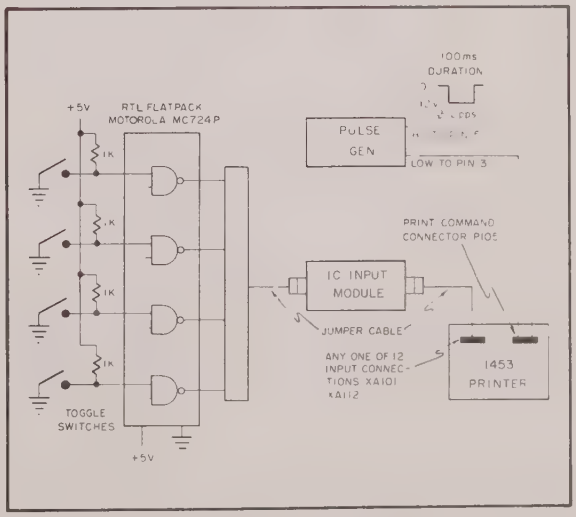


Figure 1. Testing IC Input Modules

3. PRINTER CONTROL MODULE

The Printer Control Module provides the proper interface between Beckman Models 6148, 6200 Series or 6300 Series Counters and Model 1453 Printer. This module is encapsulated in plastic and inserted between the normal printer control input plug (J409) and the control input receptacle (P105). A physical layout of the control module is shown on page 10 (dwg. no. C525702).

The standard Model 1453 Print Command input is a 0 to -12 volt pulse of 100 milliseconds duration. The data source counting units emit a print command of 0 to +5 volts of 25 microseconds duration. The Printer Control Module accepts this short duration IC logic level pulse and converts it to a pulse of standard level and duration (0 to -12 volt pulse of 100 milliseconds duration). In addition, it furnishes an inhibit (0 volt) level to the counters immediately upon receipt of the print command pulse. This inhibit pulse remains at ground level until the Model 1453 Printer is ready to accept another print command.

A schematic diagram of the Printer Control Module is shown on page 9 (dwg. no. D525731). This module consists primarily of two one-shots and a level changer. A 0 to +5 volt print command pulse is received from a counter (or other device) and applied to a filter for purposes of noise rejection. The 47Ω resistor (R1) and 0.01μf capacitor (C1) are selected for the 25 microsecond print command pulses emitted by the data source counting units. The capacitor value has to be lowered if shorter input pulses are encountered from other devices. The input pulse is inverted by one DTL NAND gate and used to set two dc flip-flops, made by connecting NAND gates back-to-back. When set, each flip-flop causes clamp transistors Q1 and Q2 to turn off. These clamp transistors are connected across the 2.5 microfarad capacitors in the two delay circuits. Capacitors C2 and C3 commence charging toward +8 volts. When the firing point of the unijunction transistors, Q4 and Q5, is reached, the capacitors quickly discharge. The discharge pulse is coupled through transistors Q7 and Q8 to the reset side of the flip-flops.

The upper delay circuit (Q1, Q4, Q7) is set for a nominal delay of 100 milliseconds. This causes the level changer Q3, which is connected to the set side (pin 11 of Z1) of the upper flip-flop, to produce a 100 millisecond -14 volt pulse which is used as a Model 1453 Print Command input (pin 5 of J1).

The second delay circuit (Q2, Q5, Q8) is set to a nominal value of 400 milliseconds. The purpose of this delay and its associated flip-flop is to provide an inhibit signal to the input counter which is turned on simultaneously with the print command and remains on until the printer is ready to accept another print command.

The duration of the delay in the two delay circuits is adjusted by selecting the value of R6 and R7. These resistors are selected when the module is tested. Resistor R6 is chosen to provide a 100 millisecond print command at pin 5 of J1; R7 to provide a 400 millisecond inhibit pulse at pin 1 of P1. To test the module, apply +8 volts to pin 4 of J1 and -14 volts to pin 8 of J1. If pin 5 of P1 is left open, simulating a constant true input signal, both one-shots will free run. Place a scope across C2 and C3 to measure the delay runup time. Select R6 and R7 to provide the correct ramp lengths of 100 and 400 milliseconds, respectively.

4. FOUR-LINE INPUT CABLE

Wiring for the input cable is shown on pages 11 and 12. This cable is used to connect Model 6148, 6200 and 6300 Series counters to a Model 1453 Printer equipped with IC Input Modules and the IC-compatible control module.

5. MODEL 1453 PRINTER MODIFICATION

If a printer has not been designed for use with the IC Control Module, a two-wire modification to the printer is necessary. To route power to the Control Module, tie +8 volts and -14 volts to pins 4 and 8, respectively, of P105 as follows:

1) Solder two wires to tabs on the power supply filter capacitors which have the two required voltages.

2) Pass the wires up through the printer chassis and over to the top of P105.

3) Strip the wires and wrap them around pins 4 and 8.

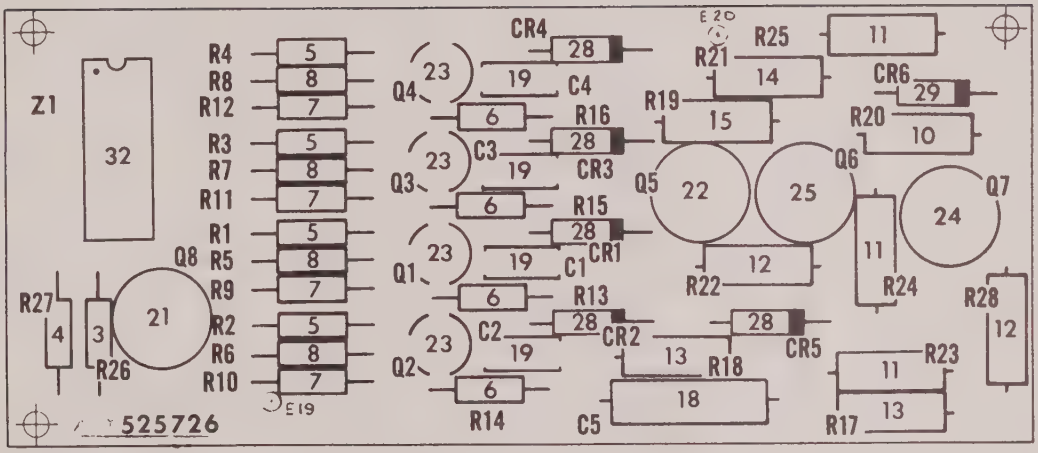
4) Solder the wires to the bottom of the pins.

5) Push J1 of the IC Control Module into place over the newly soldered wires.

NOTE

Pins 3 and 7 of P1 are connected together inside the cover of P1.

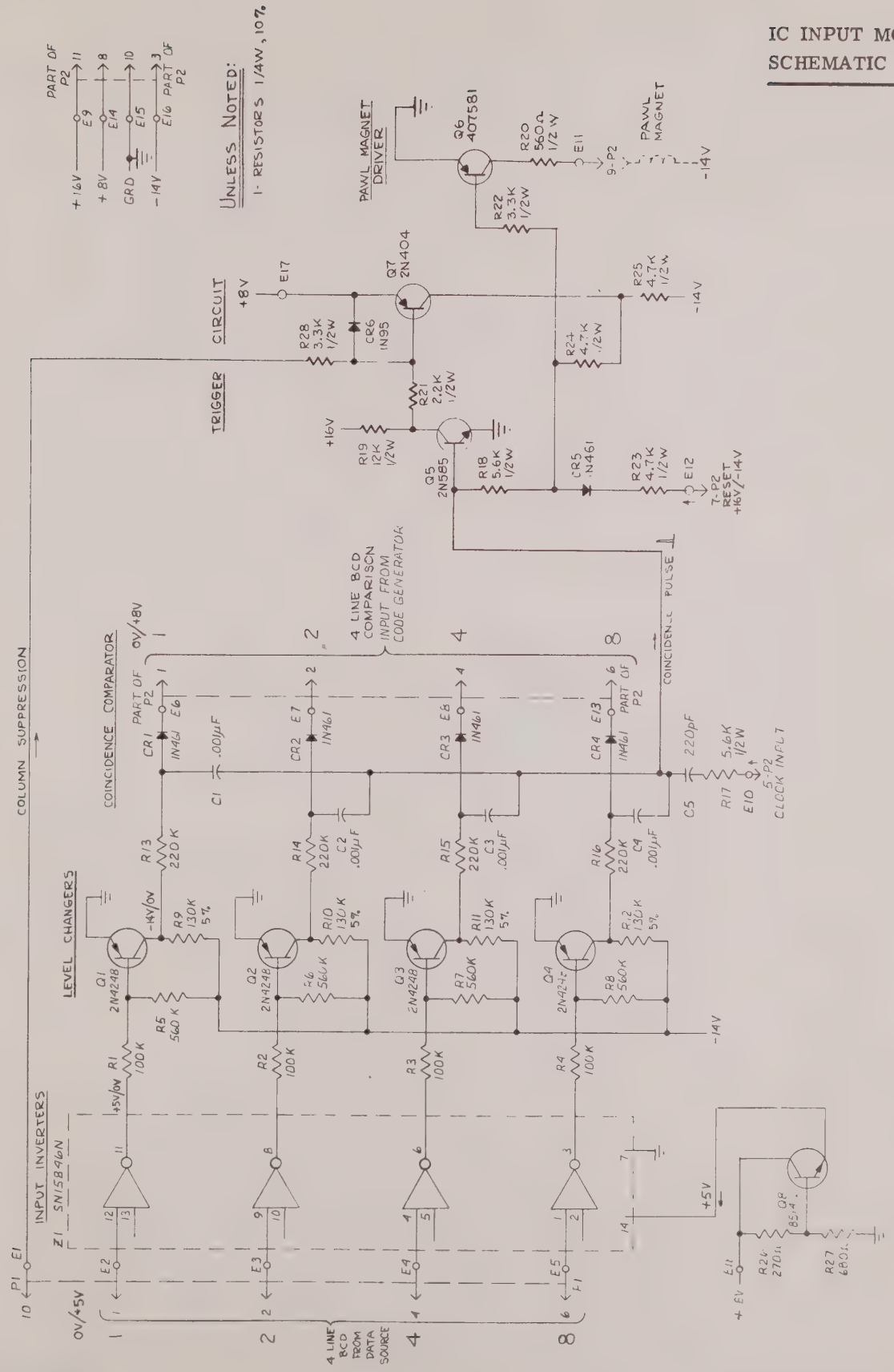
The code control is now 1-2-4-8, which is compatible with Beckman Models 6148, 6200 Series and 6300 Series instruments.

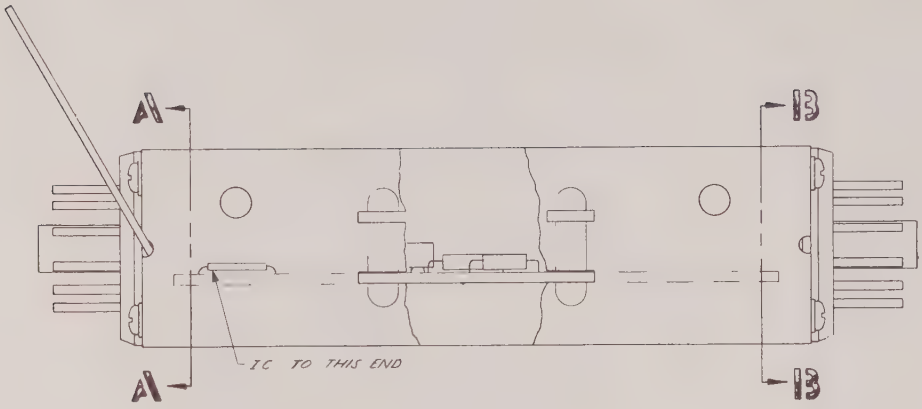


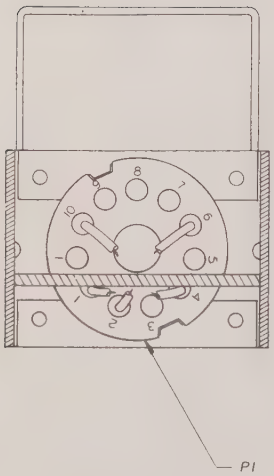
IC INPUT MODULE PRINTED WIRING ASSEMBLY

PARTS LIST
IC INPUT MODULE

Item No.	Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
		855-525726-B	IC Input Module P.C. Board Assy.	Beckman	1
19	C1 thru 4	637-822757	Capacitor, 0.001μf, 100V, 5%	Electromotive DM15F102J0-100WV4CR	4
18	C5	637-804765	Capacitor, 220pf, 500V, 5%	Electromotive CM15E221J03	1
28	CR1 thru 5	755-828971	Diode	Texas Insts. 1N461	5
29	CR6	755-402107	Diode, Special	Beckman	1
23	Q1 thru 4	755-846416	Transistor	Fairchild 2N4248	4
22	Q5	755-800415	Transistor	G.E. 2N585	1
25	Q6	755-407581	Transistor	Beckman	1
24	Q7	755-800398	Transistor	Texas Insts. 2N404	1
21	Q8	755-851412	Transistor, Special	Beckman	1
5	R1 thru 4	601-812741	Resistor, 100K, 1/4W, 10%	Allen Bradley CB1041	4
8	R5 thru 8	601-823962	Resistor, 560K, 1/4W, 10%	Allen Bradley CB5641	4
7	R9 thru 12	601-819675	Resistor, 130K, 1/4W, 5%	Allen Bradley CB1345	4
6	R13 thru 16	601-812742	Resistor, 220K, 1/4W, 10%	Allen Bradley CB2241	4
13	R17, 18	601-008085	Resistor, 5.6K, 1/2W, 10%	Allen Bradley EB5621	2
15	R19	601-008089	Resistor, 12K, 1/2W, 10%	Allen Bradley EB1231	1
10	R20	601-008073	Resistor, 560Ω, 1/2W, 10%	Allen Bradley EB5611	1
14	R21	601-008080	Resistor, 2.2K, 1/2W, 10%	Allen Bradley EB2221	1
12	R22, 28	601-010684	Resistor, 3.3K, 1/2W, 10%	Allen Bradley EB3321	2
11	R23, 24, 25	601-008084	Resistor, 4.7K, 1/2W, 10%	Allen Bradley EB4721	3
3	R26	601-823934	Resistor, 270Ω, 1/4W, 10%	Allen Bradley CB2711	1
4	R27	601-823937	Resistor, 680Ω, 1/4W, 10%	Allen Bradley CB6811	1
32	Z1	885-846401	Integrated Circuit	Texas Insts. SN15846N	1
26		864-811098	Transistor Pad	F.P. Adams 603090	4


UNLESS NOTED:
1- RESISTORS 1/4W, 10%
PART OF P2
+16V
+8V
GRD
-14V
PAWL MAGNET DRIVER
PAWL MAGNET
Q6 40T581
Q7 2N404
Q5 2N585
CIRCUIT
TRIGGER
+8V
-14V
+16V
+5V
COLUMN SUPPRESSION
INPUT INVERTERS
SN15846N
LEVEL CHANGERS
COINCIDENCE COMPARATOR
4 LINE BCD COMPARISON INPUT FROM CODE GENERATOR
4 LINE BCD FROM DATA SOURCE
COINCIDENCE PULSE
CLOCK INPUT
7-P2 RESET +16V/-14V
9-P2
5-P2
CR1 IN461
CR2 IN461
CR3 IN461
CR4 IN461
CR5 IN461
CR6 IN95
Q1 2N4248
Q2 2N4248
Q3 2N4248
Q4 2N4248
Z1

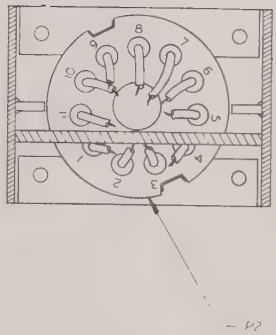




SECTION A-A

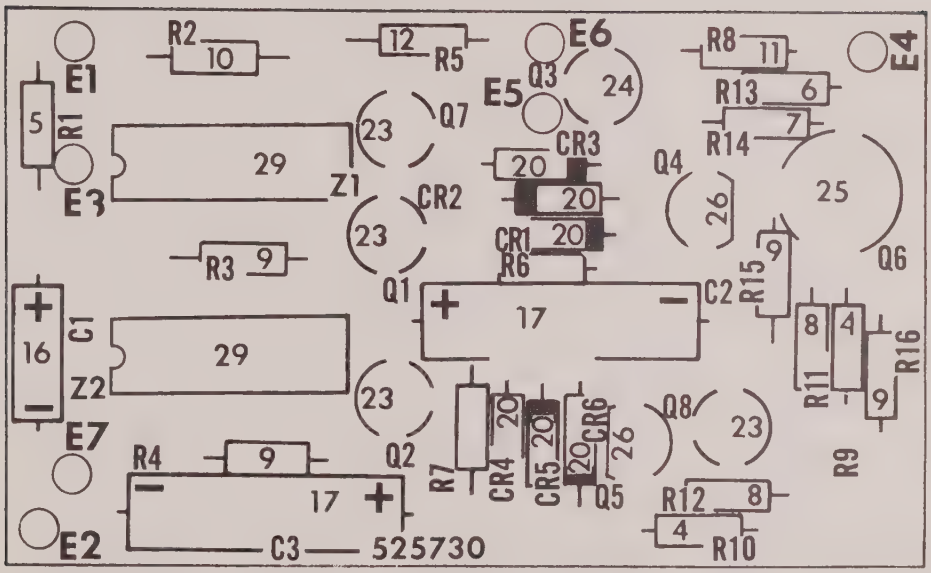
WIRE LIST

#26 AWG	COLOR	DESTINATION	LENGTH	PROCESSING
WIRE # 1	BN	FROM PIN # 1 OF P1 TO E2	4"	1/8" 3/4"
WIRE # 2	RD	FROM PIN # 2 OF P1 TO E3	4"	
WIRE # 3	OR-WH	FROM PIN # 4 OF P1 TO E4	2 3/4"	
WIRE # 4	BL	FROM PIN # 6 OF P1 TO E5	2"	
WIRE # 5	BK	FROM PIN # 10 OF P1 TO E1	5"	
WIRE # 6	BN	FROM PIN # 1 OF P2 TO E6	4 1/2"	
WIRE # 7	RD	FROM PIN # 2 OF P2 TO E7	4 1/2"	
WIRE # 8	OR	FROM PIN # 3 OF P2 TO E16	4 1/2"	
WIRE # 9	YL	FROM PIN # 4 OF P2 TO E8	4"	
WIRE # 10	GN	FROM PIN # 5 OF P2 TO E10	2"	
WIRE # 11	BL	FROM PIN # 6 OF P2 TO E13	3"	
WIRE # 12	VO	FROM PIN # 7 OF P2 TO E12	2"	
WIRE # 13	GY	FROM PIN # 8 OF P2 TO E14	2"	
WIRE # 14	WH	FROM PIN # 9 OF P2 TO E11	2"	
WIRE # 15	BK	FROM PIN # 10 OF P2 TO E15	2 1/2"	
WIRE # 16	BK-GN	FROM PIN # 11 OF P2 TO E9	3 1/2"	
WIRE # 17	BK	FROM E17 TO E18	3 1/2"	1/8"
WIRE # 18	BK	FROM E19 TO E20	2 1/2"	1/8"



SECTION B-B

IC INPUT MODULE TOP ASSEMBLY

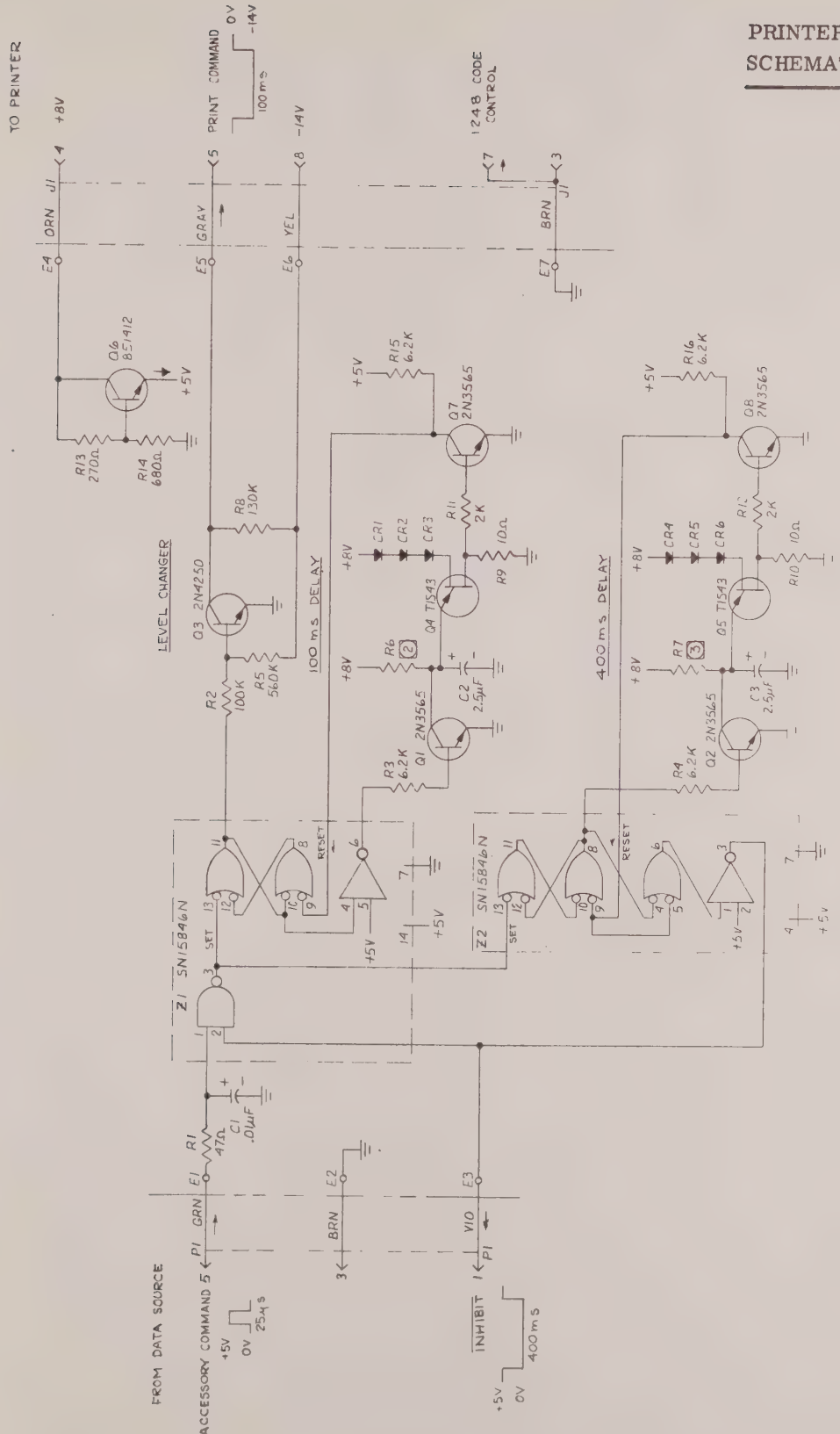


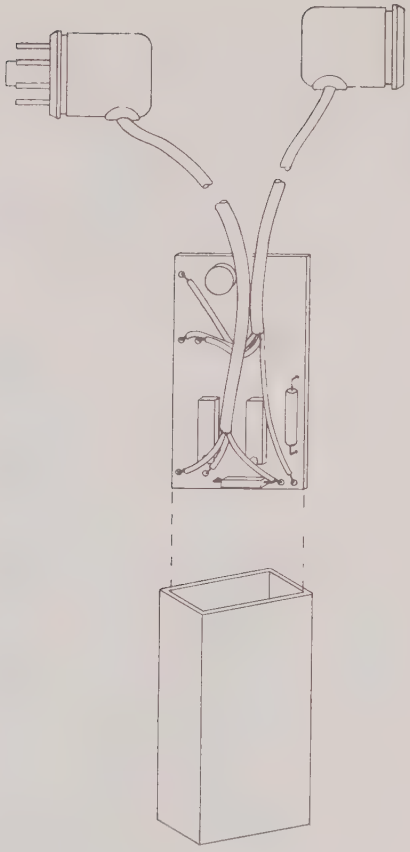
PRINTER CONTROL MODULE PRINTED WIRING ASSEMBLY

PARTS LIST

PRINTER CONTROL MODULE

Item No.	Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty./ Ass'y
		855-525730-B	Printer Control Module Assy.	Beckman	1
16	C1	639-822914	Capacitor, 0.01μf, 100V, 20%	Electron M1-103/ELP.VX1E-103	1
17	C2, 3	631-813699	Capacitor, 2.5μf, 30V, 20%	Mil. Type No. CL35BH2R5MP3	2
20	CR1 thru 6	755-845049	Diode,	Fairchild FDH627	6
23	Q1, 2, 7, 8	755-838784	Transistor	Fairchild 2N3565	4
24	Q3	755-846164	Transistor, PNP	Fairchild 2N4250	1
25	Q6	755-851412	Transistor, Special	Beckman	1
26	Q4, 5	755-846459	Transistor	Texas Insts. TIS43	2
5	R1	601-823387	Resistor, 47Ω, 1/4W, 5%	Allen Bradley CB4705	1
10	R2	601-823904	Resistor, 100K, 1/4W, 5%	Allen Bradley CB1045	1
9	R3, 4, 15, 16	601-822330	Resistor, 6.2K, 1/4W, 5%	Allen Bradley CB6225	4
12	R5	601-823913	Resistor, 560K, 1/4W, 5%	Allen Bradley CB5645	1
13	R6, 7	xxx-xxxxxx	Resistor, Selected	Beckman	2
11	R8	601-819675	Resistor, 130K, 1/4W, 5%	Allen Bradley CB1345	1
4	R9, 10	601-823379	Resistor, 10Ω, 1/4W, 5%	Allen Bradley CB1005	2
8	R11, 12	601-822293	Resistor, 2K, 1/4W, 5%	Allen Bradley CB2025	2
6	R13	601-823393	Resistor, 270Ω, 1/4W, 5%	Allen Bradley CB2715	1
7	R14	601-822369	Resistor, 680Ω, 1/4W, 5%	Allen Bradley CB6815	1
29	Z1, 2	885-846401	Integrated Circuit	Texas Instruments SN15846N	2
27		864-811098	Transistor Pad	F. P. Adams 603090	1


TO PRINTER
+8V
PRINT COMMAND
0V
-14V
100 ms
1248 CODE CONTROL
J1
ORN
GRAY
YEL
BRN
E4
E5
E6
E7
Q6 85412
+5V
R13 270Ω
R14 680Ω
R8 130K
LEVEL CHANGER
Q3 2N4250
R2 100K
R5 560K
100 ms DELAY
R15 6.2K
Q7 2N3565
CR1
CR2
CR3
R11 2K
R9 10Ω
Q4 T1543
R6
C2 2.5μF
Q1 2N3565
R3 6.2K
400 ms DELAY
R16 6.2K
Q8 2N3565
CR4
CR5
CR6
R12 2K
R10 10Ω
Q5 T1543
R7
C3 2.5μF
Q2 2N3565
R4 6.2K
RESET
SET
Z1 SN15846N
Z2 SN15846N
R1 47Ω
C1 .01μF
FROM DATA SOURCE
ACCESSORY COMMAND 5
+5V
0V
25μs
GRN
BRN
VIO
P1
E1
E2
E3
INHIBIT
400 ms



WIRING LIST	
WIRE # 1	FROM PIN # 1 OF P1 TO E3
WIRE # 2	FROM PIN # 3 OF P1 TO E2
WIRE # 3	FROM PIN # 5 OF P1 TO E1
WIRE # 4	FROM PIN # 3 OF J1 TO E7
WIRE # 5	FROM PIN # 4 OF J1 TO E4
WIRE # 6	FROM PIN # 5 OF J1 TO E5
WIRE # 7	FROM PIN # 8 OF J1 TO E6
WIRE # 8	FROM PIN # 3 OF J1 TO PIN # 7 OF J1

PRINTER CONTROL MODULE TOP ASSEMBLY

FOUR-LINE INPUT CABLE
8 COLUMN
SCHEMATIC DIAGRAM

6. IC CONTROL MODULE (Revised)

(Assembly No. A855-436957)

This module is intended to interface control signals from IC level data sources to the Model 1453 control electronics.

The IC Control Module Board Assembly drawing (A436957) and its associated parts list is shown on page 13; the schematic diagram (B436956) on page 14.

A. PRINT COMMAND (pin 5 of P1)

Z = 1 TTL Load ≅ 3K

1) Accepts positive-going IC level pulse from data source, 30 μs nominal. IC levels defined as:

   0 = +0.45V
   1 = +2.5 to +5.5V

2) Pulse can be as narrow as 50 ns or as long as desired with the following understanding:

   (a) A single-shot will extend all pulses of < 100 ms to approximately 100 ms and present this extended pulse to the printer on pin 5 of J1.

   (b) Input pulses > 100 ms in duration will override the single-shot and the longer pulse will be applied to the printer. If this is the case, the minimum time between print command pulses is 15 ms.

B. INHIBIT

This signal is a contact closure through 220Ω to ground. It is furnished by the printer to keep the data source constant during the time the data is being processed. No new print command signals should be issued by the data source during this time.

The inhibit return is dependent upon the mechanical action of the printer and because of this it may be too slow in being applied to the data source to prevent updating. To combat this possible problem, the actual inhibit signal returned to the data source is an OR function of the print command single-shot output and the printer inhibit signal. In this way the data source is inhibited immediately by the print command signal and remains inhibited for the duration of the printer inhibit signal.

Upon termination of the inhibit signal at pin 1 of P1, the data source is free to update and the printer ready to receive a new print command.

C. COLOR CONTROL (Pin 6 of P1)

Input Z = 6.8K

The printer is capable of red or black printout. Black printout is automatic and no external control is required, although an IC high level (logic 1) can be on the color control line (pin 6 of P1).

For red printout, pin 6 of P1 must be at ground or IC logic 0.

The color control signal can be continuously applied or applied only when a print command is issued. It should remain constant during the actual printing sequence. The signal to the printer (pin 6, J1) is Black, -14 volts through 120K and Red, ground through saturated Q3.

D. PRINTING RATE

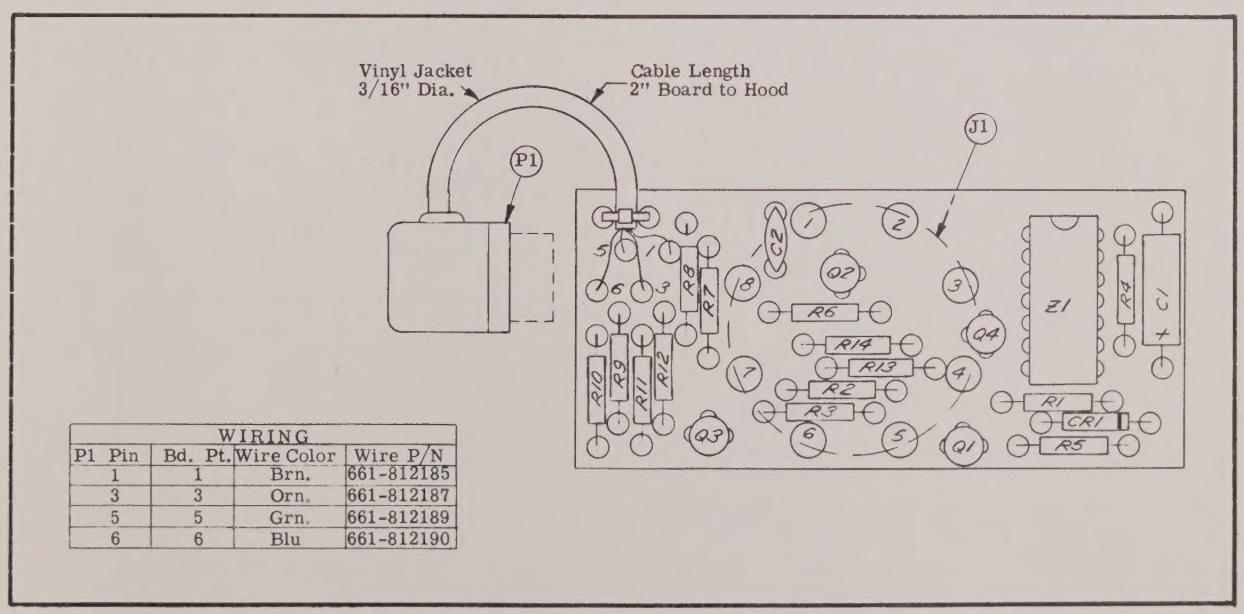
The IC control module allows the printer to operate up to its maximum rate (i.e., three lines per second). The conditions for maximum operation are that the data source must be able to recycle, update its data, and provide a new print command during the interval from end-of-inhibit to end-of-print cycle. This time is approximately 100 ms or less.

This assembly mounts in the Model 1453 printer mechanism by plugging directly onto connector P105. The cable end connects to J409 of the printer cable.

PARTS LIST
IC CONTROL MODULE

Detail No.	Beckman Stock No.	Description	Typical Manufacturer & No.	Qty. / Ass'y
	A855-436957 (A)	PC Board Assembly	Beckman	
C1	631-857298	Capacitor, F. Tant, Elect, 22μf, 25V	Comp. Inc. TSD5-25-226	1
C2	633-836864	Capacitor, F. Cerm, 0.01μf, 100V	Sprague C023B101F103M	1
CR1	755-420893	Diode, Special	Beckman	1
Q1, 3	755-846164	Transistor, PNP	Fairchild 2N4250	2
Q2	755-857274	Transistor, NPN	Fairchild 2N4275	1
Q4	755-838784	Transistor, NPN	Fairchild 2N3565	1
R1, 10	601-823904	Resistor, 100K	*AB CB1045	2
R2, 11	601-823913	Resistor, 560K	AB CB5645	2
R3, 12	601-823905	Resistor, 120K	AB CB1245	2
R4	601-823391	Resistor, 150Ω	AB CB1515	1
R5, 8	601-822334	Resistor, 22K	AB CB2235	2
R6, 14	601-822328	Resistor, 2.2K	AB CB2225	2
R7, 9	601-822299	Resistor, 6.8K	AB CB6825	2
R13	601-822308	Resistor, 1K	AB CB1025	1
Z1	885-435206	I. C., Quad Two Input Gate, U6A900259X	Fairchild	1
J1	860-079512	Socket, Octal, PC Mount	Cinch 101-04-00-078	1
P1	678-099028	Connector, Plug, Header, Octal	Jones 8PB	1

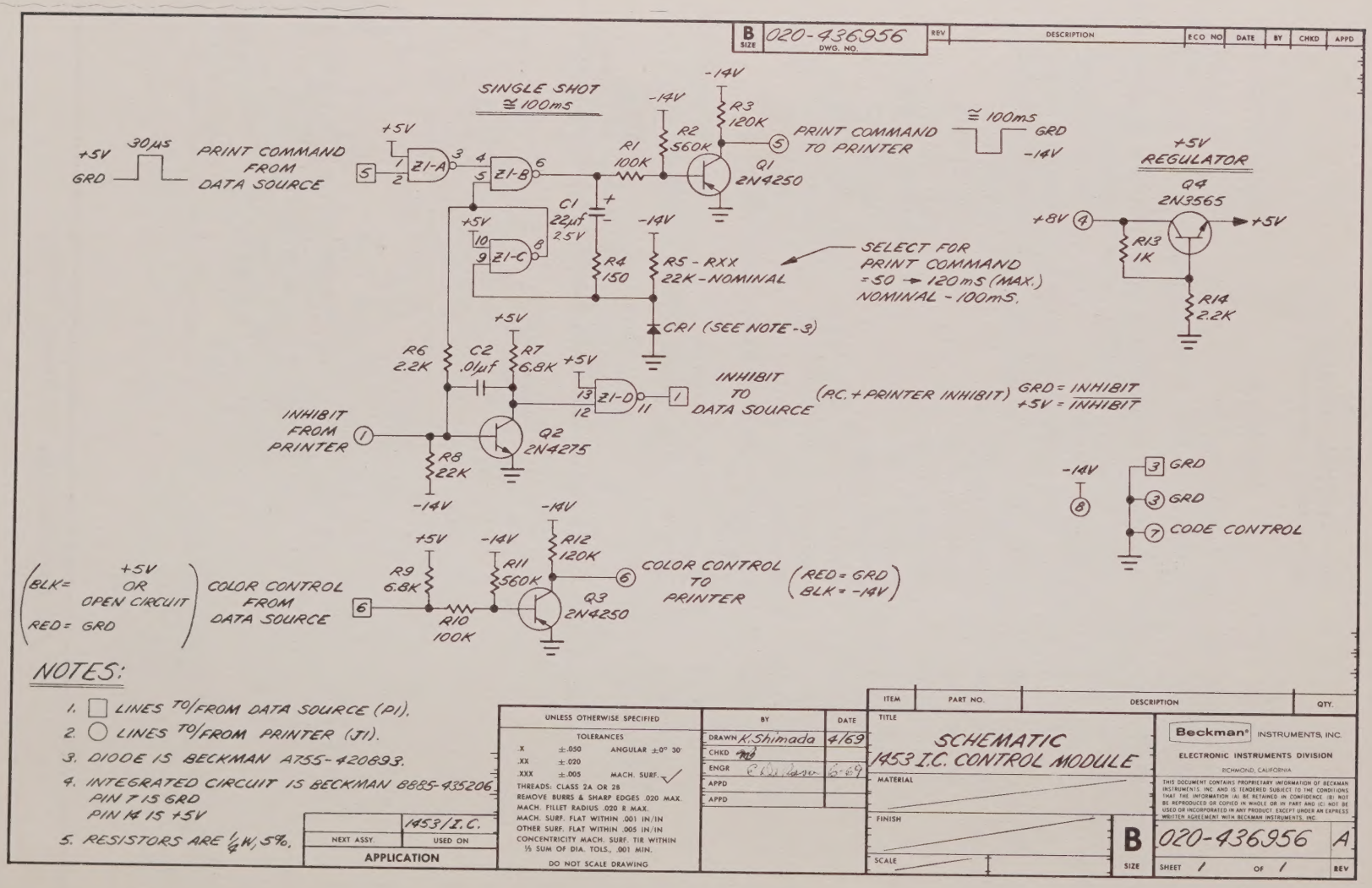
*Allen Bradley, F. Comp., 1/4W, 5%



WIRING

P1 Pin	Bd. Pt.	Wire Color	Wire P/N
1	1	Brn.	661-812185
3	3	Orn.	661-812187
5	5	Grn.	661-812189
6	6	Blu	661-812190

PC Board Assembly, IC Control Module



NOTES:

1. □ LINES TO/FROM DATA SOURCE (P1).
2. ○ LINES TO/FROM PRINTER (J1).
3. DIODE IS BECKMAN A755-420893.
4. INTEGRATED CIRCUIT IS BECKMAN 8885-435206
   PIN 7 IS GRD
   PIN 14 IS +5V
5. RESISTORS ARE ¼W, 5%.

UNLESS OTHERWISE SPECIFIED	BY	DATE
TOLERANCES: .X ±.050 ANGULAR ±0° 30'; .XX ±.020; .XXX ±.005 MACH. SURF. ✓	DRAWN K. Shimada	4/69
THREADS: CLASS 2A OR 2B	CHKD	
REMOVE BURRS & SHARP EDGES .020 MAX.	ENGR	6-6-69
MACH. FILLET RADIUS .020 R MAX.	APPD	
MACH. SURF. FLAT WITHIN .001 IN/IN	APPD	
OTHER SURF. FLAT WITHIN .005 IN/IN		
CONCENTRICITY MACH. SURF. TIR WITHIN ½ SUM OF DIA. TOLS., .001 MIN.		
DO NOT SCALE DRAWING		

NEXT ASSY.	USED ON
	1453/I.C.
APPLICATION	

ITEM	PART NO.	DESCRIPTION	QTY.

TITLE: SCHEMATIC 1453 I.C. CONTROL MODULE

MATERIAL

FINISH

SCALE

B SIZE

Beckman® INSTRUMENTS, INC.
ELECTRONIC INSTRUMENTS DIVISION
RICHMOND, CALIFORNIA

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